CHAPTER 77

LIST OF EFFECTIVE TEMPORARY REVISIONS

FOLLOWING IS A COMPLETE LISTING OF ALL ACTIVE TEMPORARY REVISIONS (TR'S). TR'S NOT LISTED SHOULD BE REMOVED. THE ATA NUMBER, CONFIG CODE AND PAGE NUMBER IDENTIFIES THE PAGE PRECEDING THE TR.

TR NUMBER	ATA NUMBER	CONFIG CODE	PAGE NUMBER	TR DATE

NONE

CHAPTER 77

ENGINE INDICATING

LIST OF EFFECTIVE PAGES

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77-13-00	507	Aug 15/81	1
77-13-00	508	Aug 15/81	1
77-13-00	509	Aug 15/81	1
77-13-00	510	Aug 15/81	1
77-13-00	511	Aug 15/81	1
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77-21-00	512	May 15/88	
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77-21-00	514	May 15/88	
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CHAPTER 77

ENGINE INDICATING

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	VIBRATION MONITOR SYSTEM	77-31-00		
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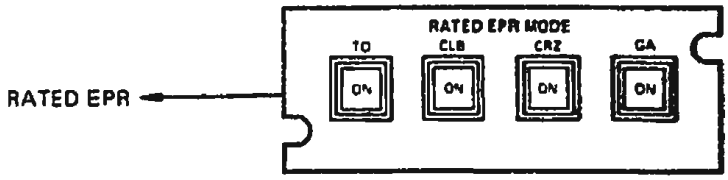


(FE/SO PANEL)

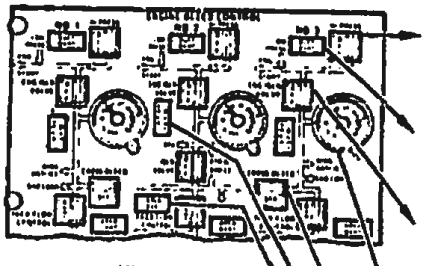
TITLE CHAP/SEC
RATED EPR 7713

M1-0001-71-8520

R ENGINE INDICATING CONTENTS

EFFECTIVITY: ALL

001B



(FE/SO PANEL)

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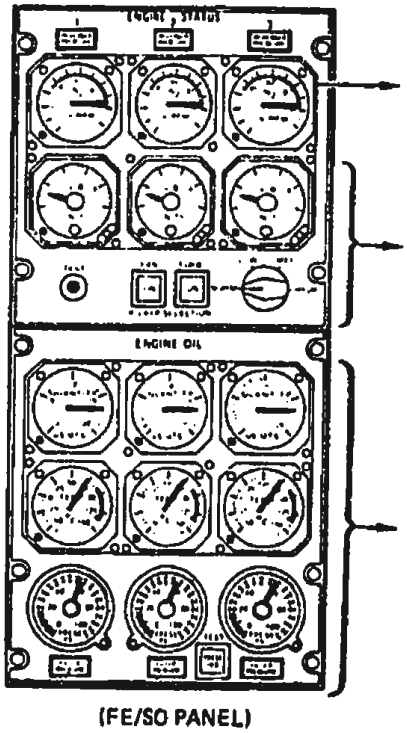
CROSSBLEED START
ENGINE BLEED AIR
NACELLE/PYLON OVERHEAT DETECTION

DUCT OVHT, ENGINE (1, 2, OR 3)

GROUND START VALVE OPEN LIGHT
ENGINE BLEED AIR

CROSSBLEED START
POSSIBLE OVERTEMPERATURE/HIGH TEMPERATURE
ENGINE BLEED AIR

CROSSBLEED START
AREA OVHT, BLEED AIR (J)
AREA OVERHEAT TEST
AREA OVHT, BLEED AIR (D, E, OR H)



(FE/SO PANEL)

STARTING

AIRBORNE VIBRATION MONITOR
N2 OVERSPEED
N2 INDICATOR

ABNORMAL OIL SYSTEM INDICATIONS
RISE IN FUEL/OIL TEMPERATURE
STARTING
OIL PRESSURE LOW/HIGH
OIL FILTER PRESSURE LIGHT
ENGINE FLAMEOUT

TITLE	CHAP/SEC
ABNORMAL OIL SYSTEM INDICATIONS	7900
AIRBORNE VIBRATION MONITOR	7731
AREA OVERHEAT TEST	3600
AREA OVHT, BLEED AIR (D, E, OR H)	3600
AREA OVHT, BLEED AIR (J)	3600
CROSSBLEED START	3600
DUCT OVHT, ENGINE (1, 2, OR 3)	3600
ENGINE BLEED AIR	3600
ENGINE FLAMEOUT	7100
GROUND START VALVE OPEN LIGHT	8011
NACELLE/PYLON OVERHEAT DETECTION	2600
N2 INDICATOR	7712
N2 OVERSPEED	7100
OIL FILTER PRESSURE LIGHT	7900
OIL PRESSURE LOW/HIGH	7900
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RISE IN FUEL/OIL TEMPERATURE	7337
STARTING	7100

M1-0002-71-8505

R ENGINE INDICATING CONTENTS

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ENGINE FLAMEOUT	7100
ENG 2 FAIL LIGHT	7714
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GROUND START VALVE OPEN LIGHT	8011
IN-FLIGHT SURGE	7100
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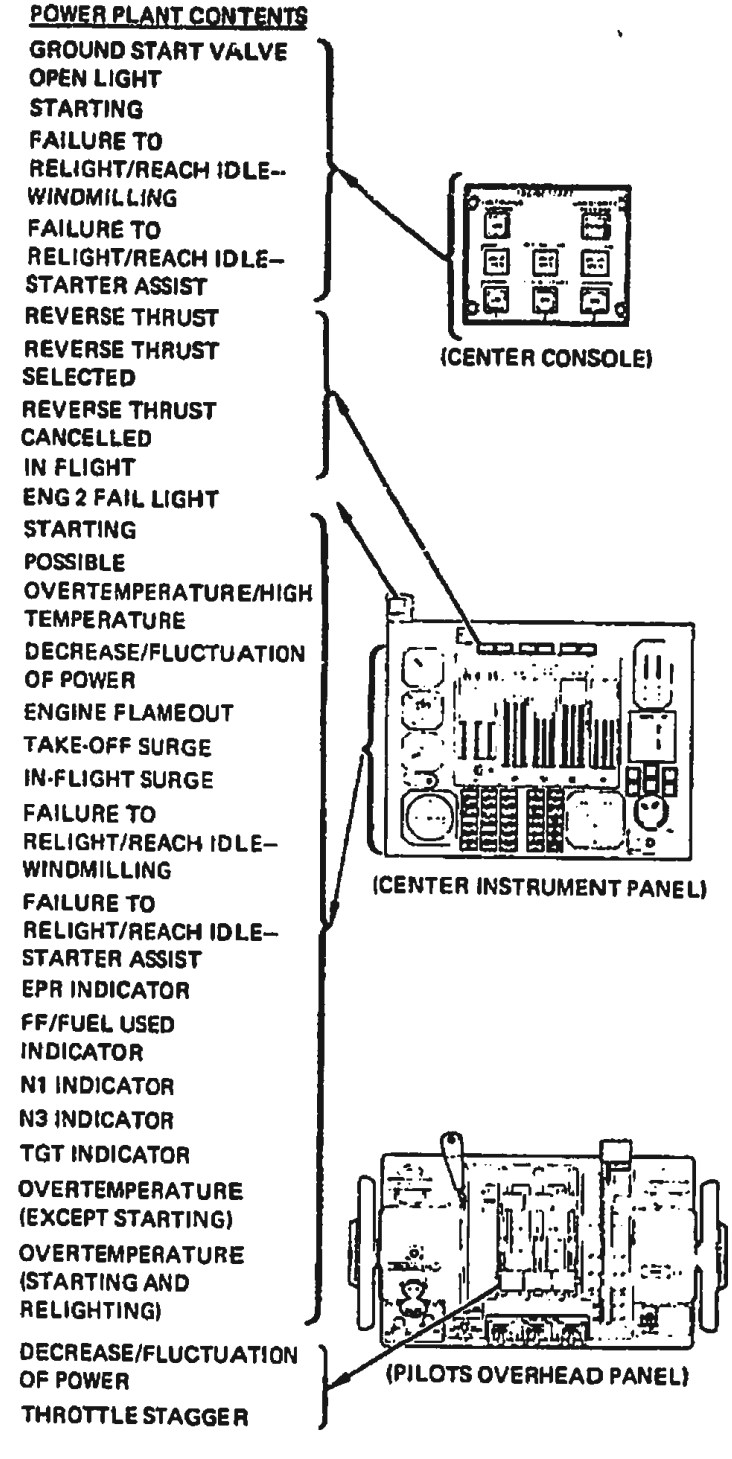


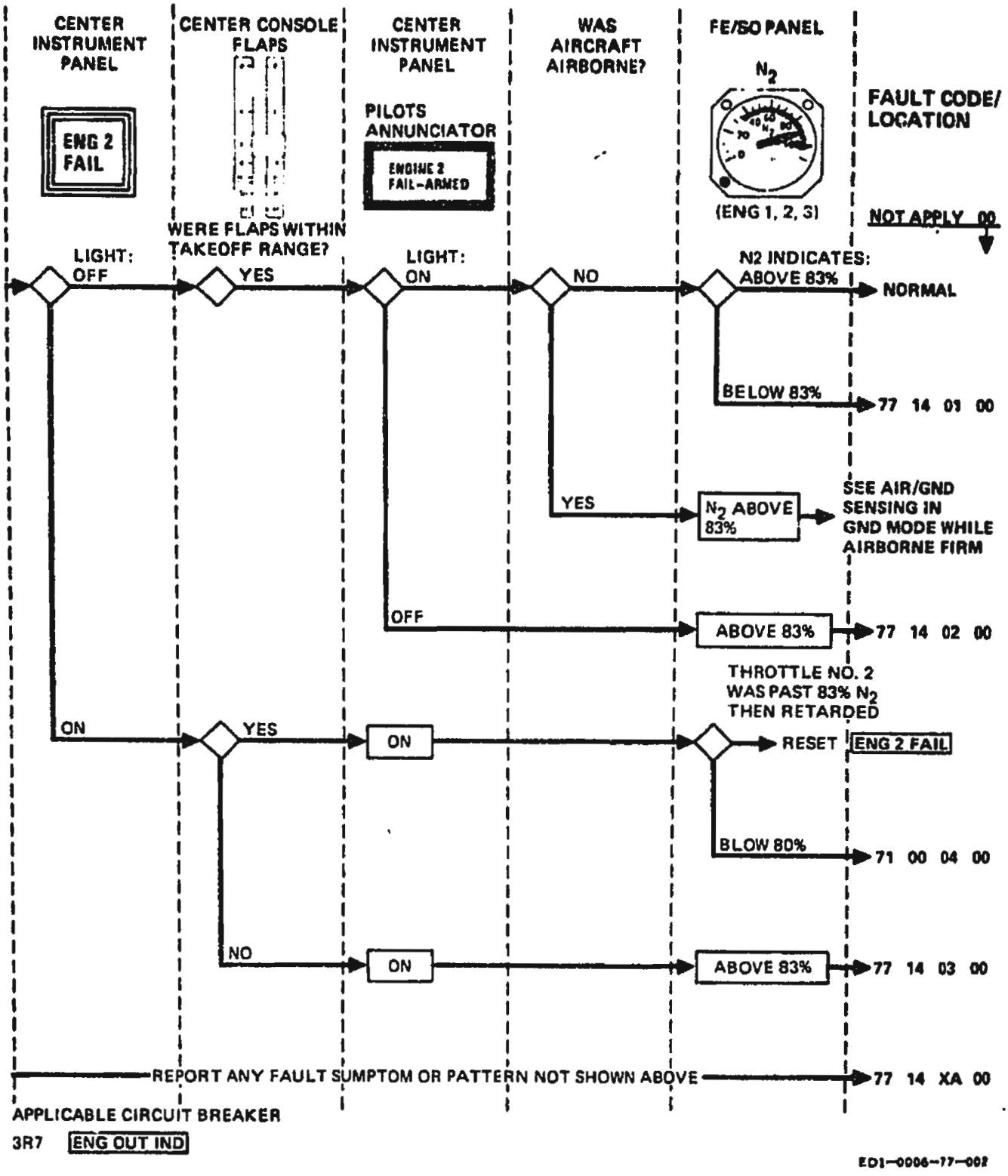
M1–0001–71–8504

R ENGINE INDICATING CONTENTS

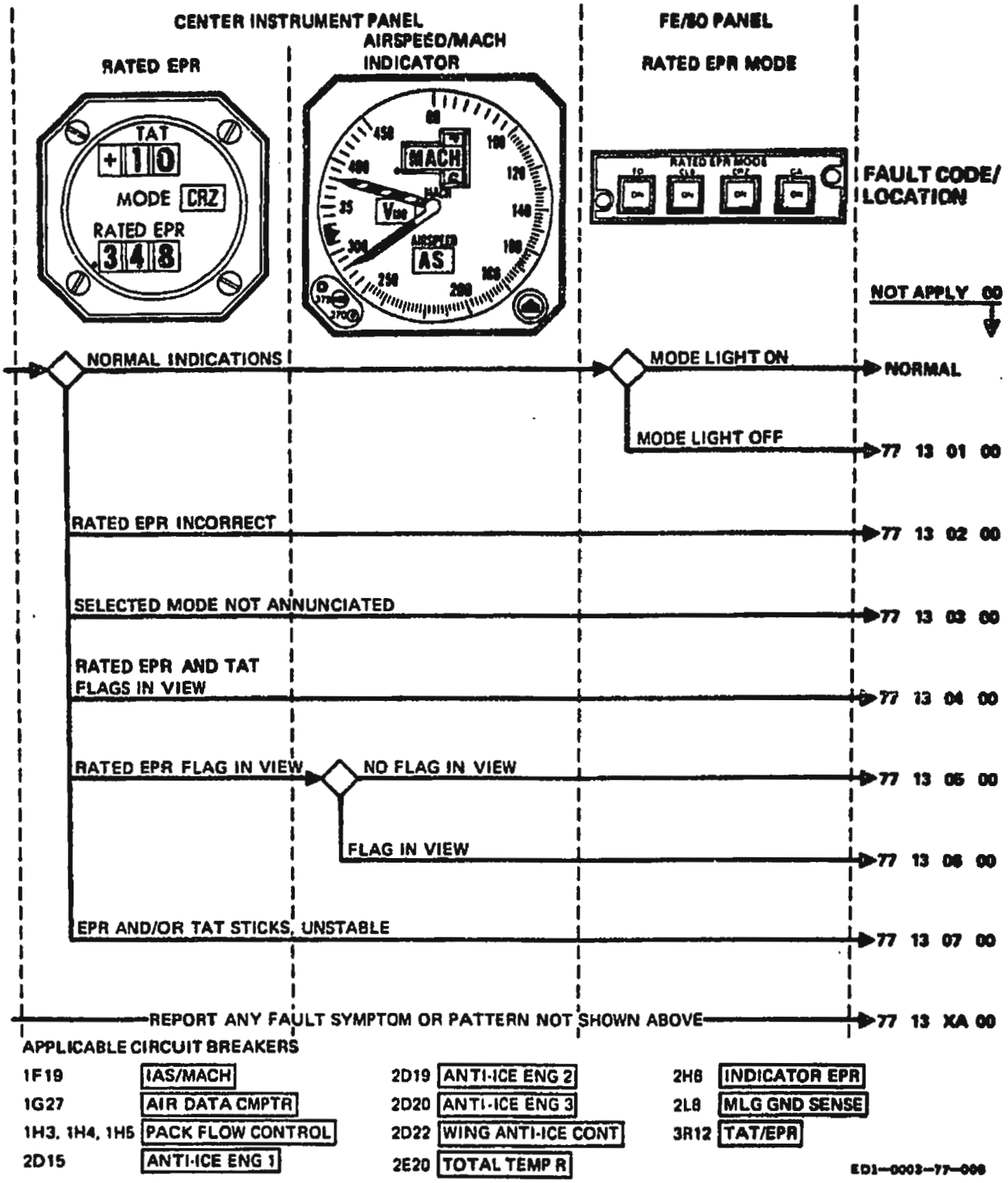
R EFFECTIVITY: ALL

R

001B



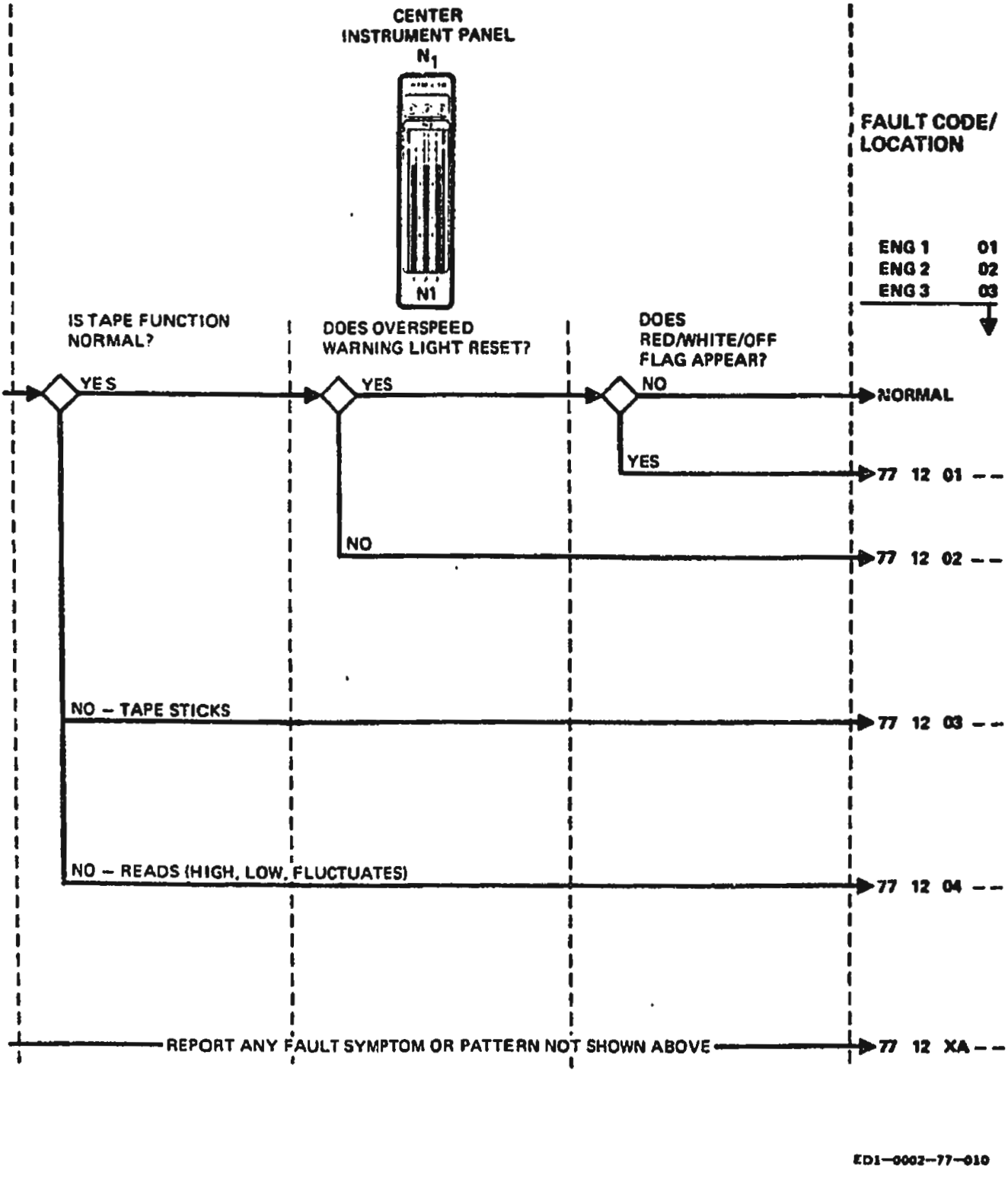
R ENG 2 FAIL Light - Fault Codes
Figure 1



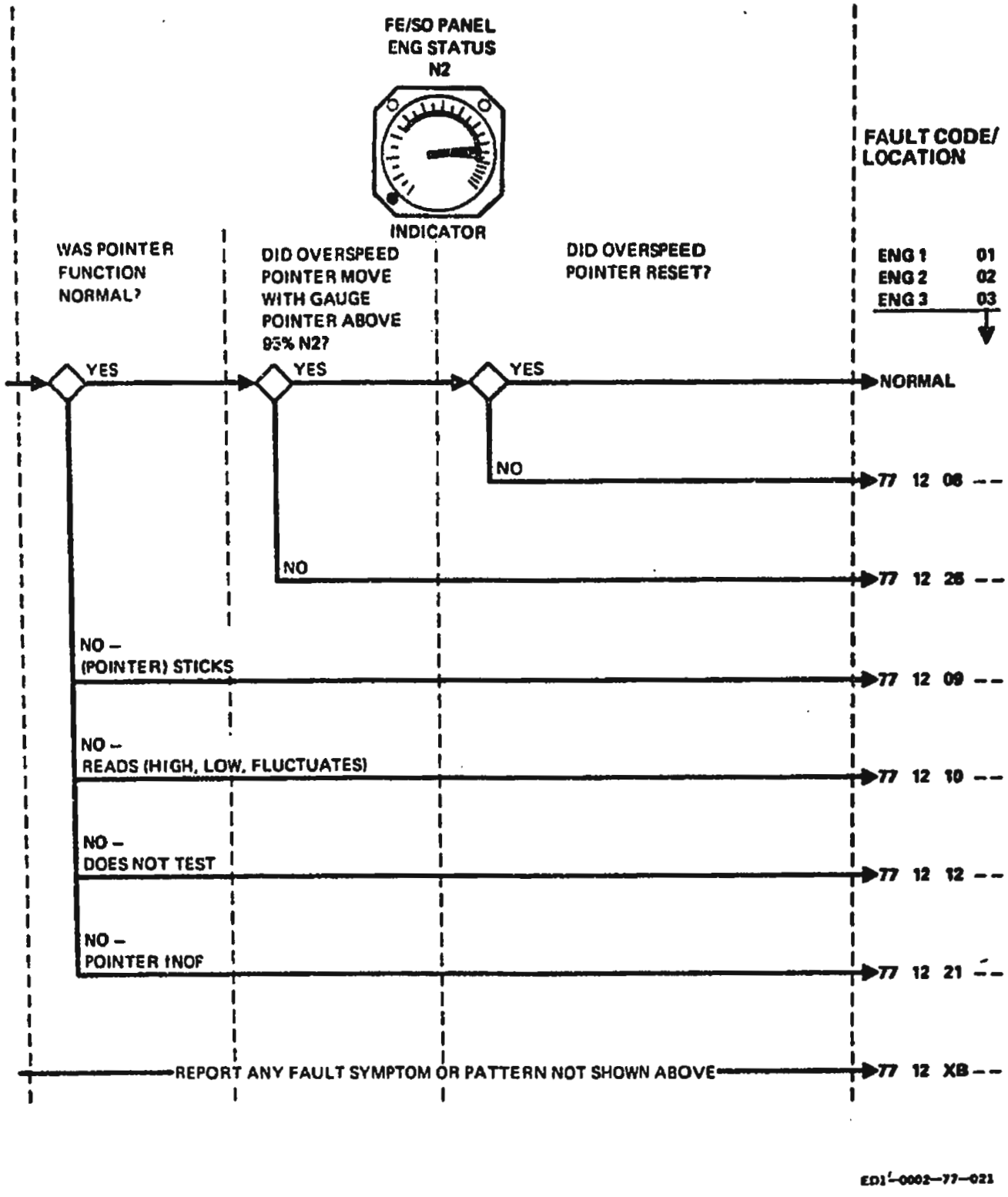
R Rated EPR - Fault Codes
Figure 2

R EFFECTIVITY: ALL

77-FAULT CODE DIAGRAM



R N1 Indicator Faults - Fault Codes
Figure 3

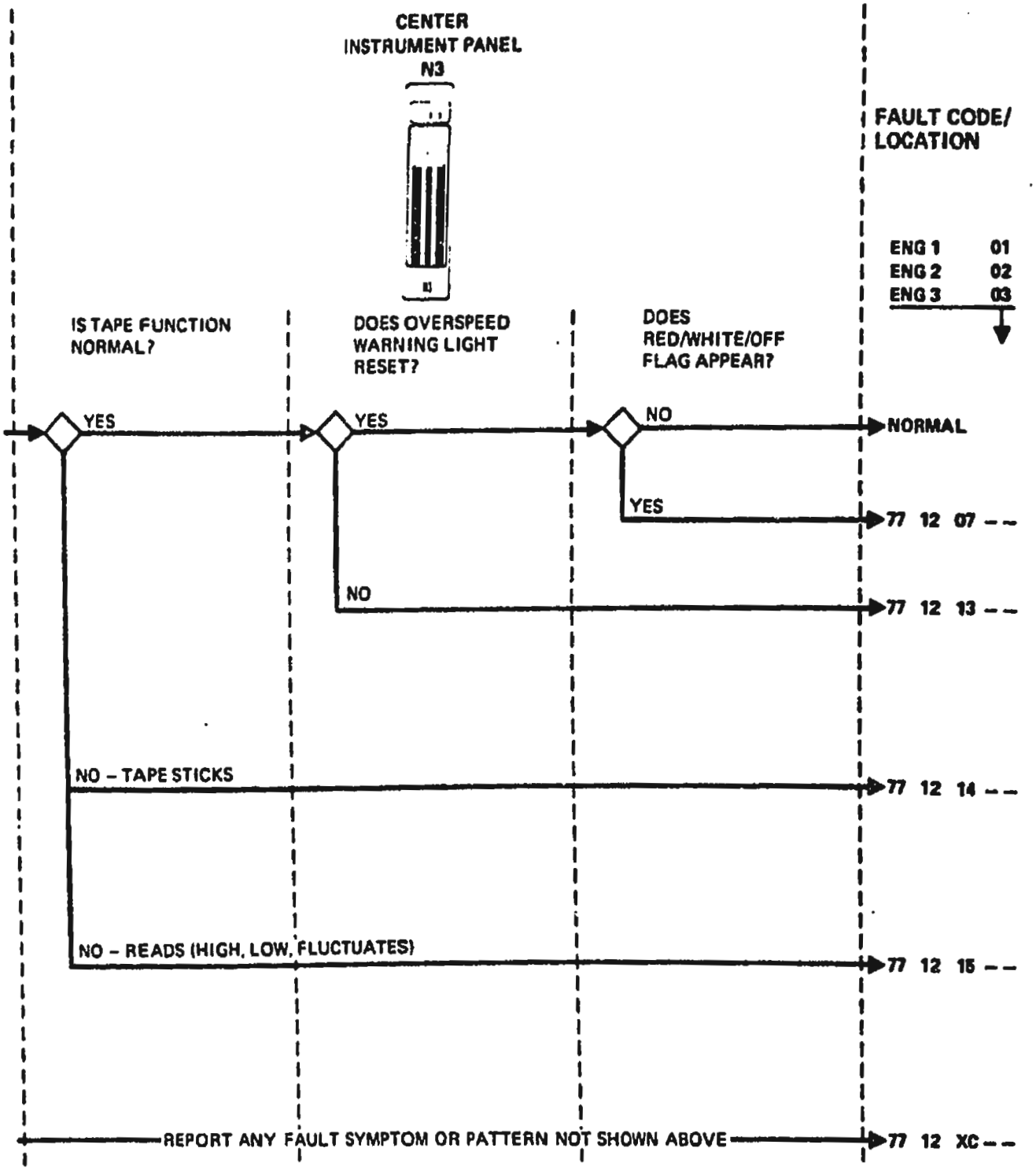


R N2 Indicator Faults - Fault Codes
Figure 4

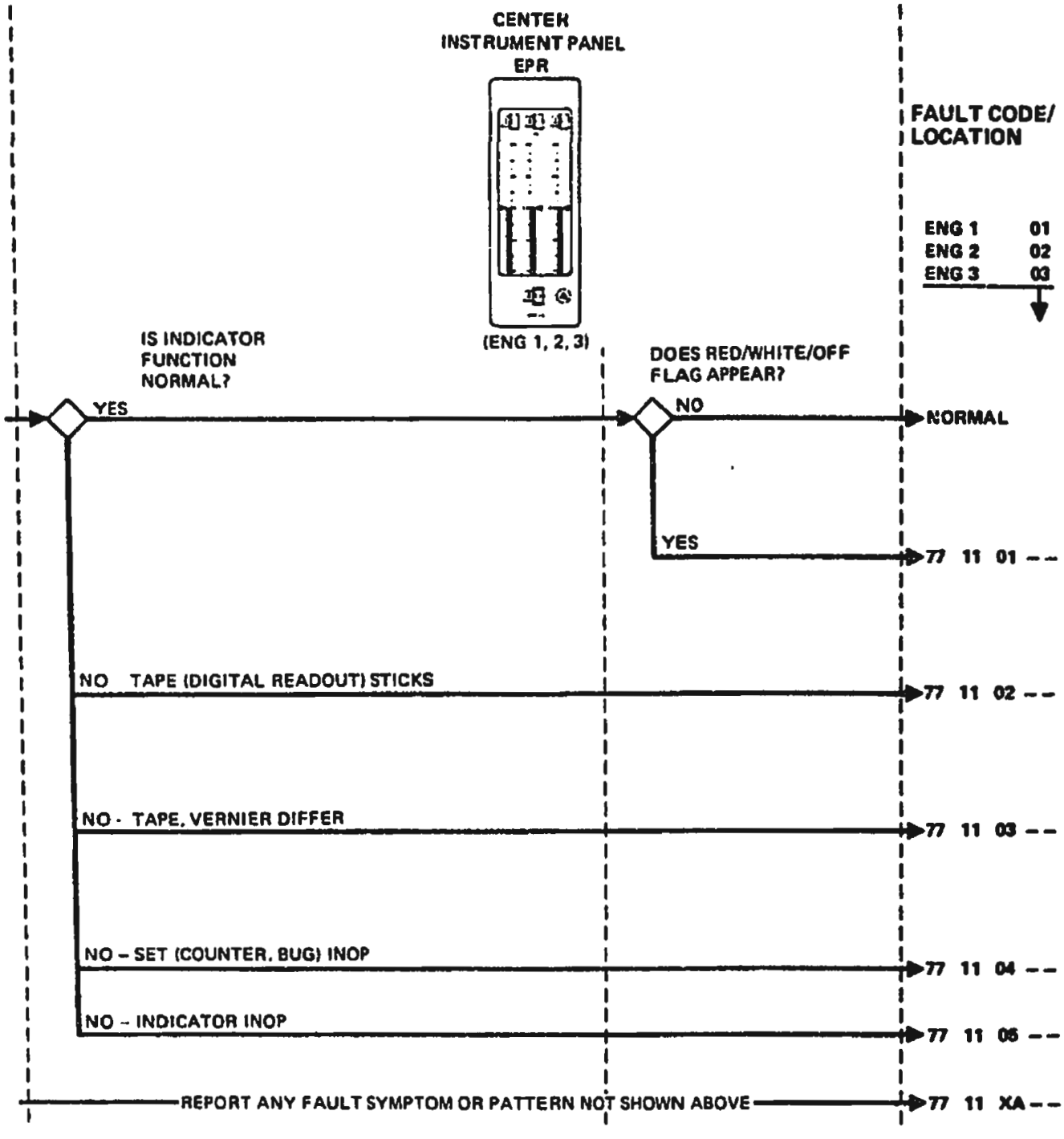
R EFFECTIVITY: ALL

0508

77-FAULT CODE DIAGRAM



R N3 Indicator Faults - Fault Codes
Figure 5

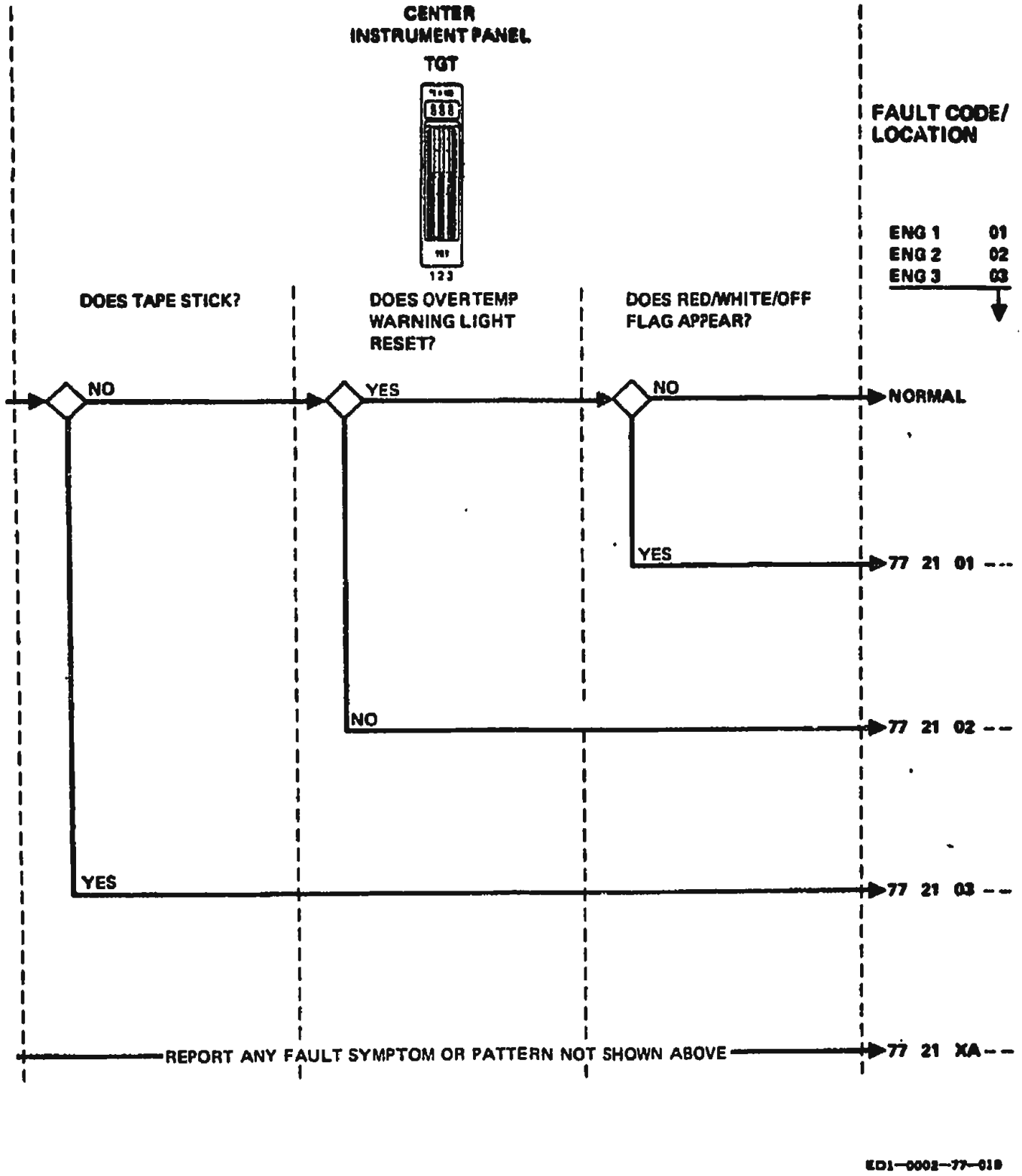


ED1-0002-77-016

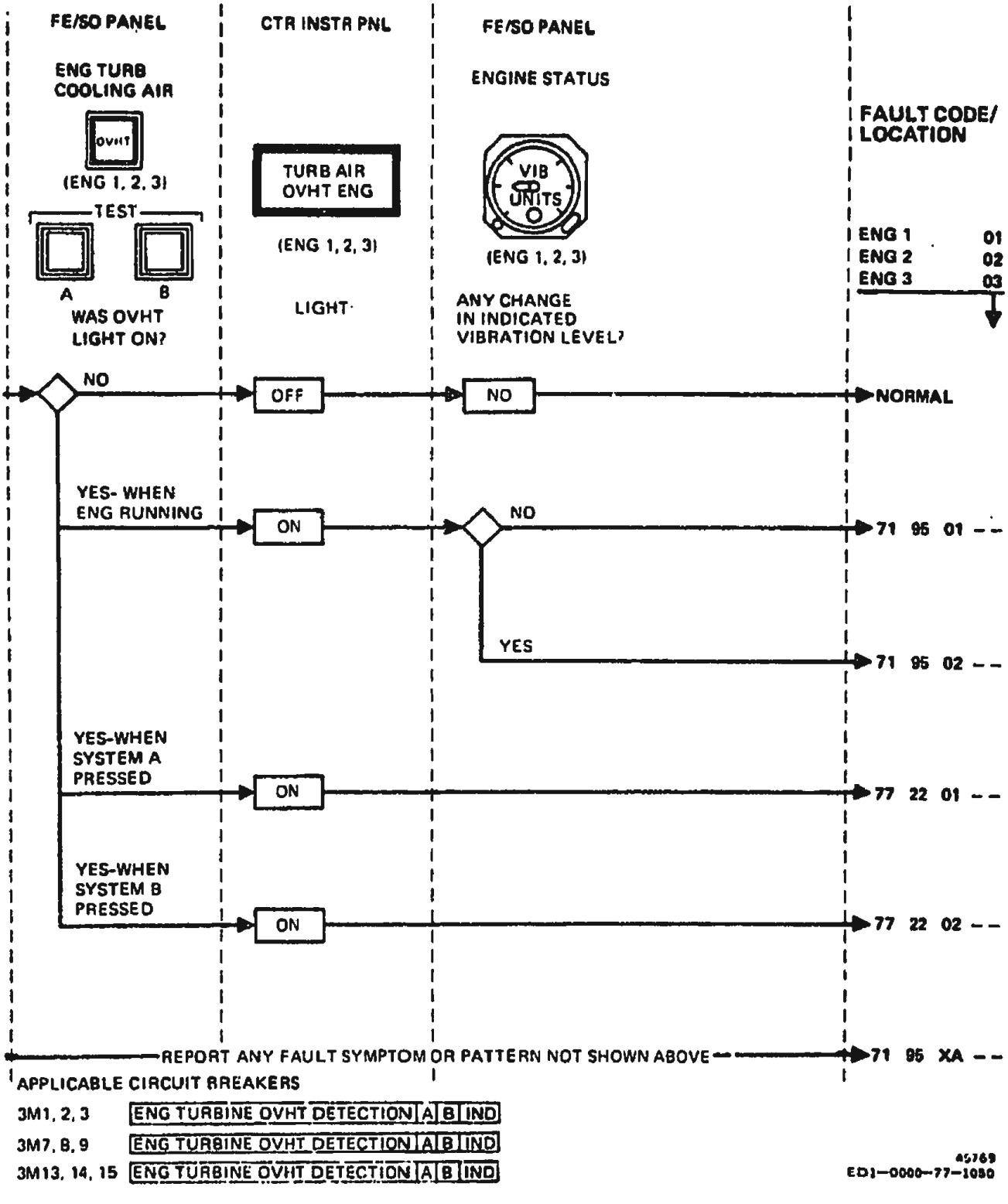
R EPR Indicator Faults - Fault Codes
Figure 6

EFFECTIVITY: ALL

77-FAULT CODE DIAGRAM



R TGT Indicator Faults - Fault Codes
Figure 7



R Engine Turbine Cooling Air Overheat - Fault Codes
Figure 8

FAULT CODE INDEX
TABLE 1

	FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
	77 11 XA __	1. An EPR Indicator Faults fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
R		2. 77-11-00 Fig. 103 Block 1
	77 12 XA __	1. A N1 Indicator Faults fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
R		2. 77-12-00 Fig. 103 Block 1
	77 12 XB __	1. A N2 Indicator Faults fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
R		2. 77-12-00 Fig. 104 Block 1
	77 12 XC __	1. A N3 Indicator Faults fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
R		2. 77-12-00 Fig. 103 Block 1
	77 13 XA 00	1. A Rated EPR fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
R		2. 77-13-00 Fig. 103, 104, 105, 106 Block 1
	77 14 XA 00	1. An ENG 2 FAIL Light fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.)
R		2. 77-14-00 Fig. 103 Block 1

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
77 21 XA __	1. A TGT Indicator Faults fault was encountered by the crew which is not covered in the fault code diagram. (Ref. Fault Code diagram for flight crew actions.) 2. 77-21-00 Fig. 103 Block 1
77 11 01 __	1. (01=ENG 1, 02=ENG 2, 03=ENG 3) EPR RED/WHITE/OFF flag appears. 2. 77-11-00 Fig. 103 Block 19
77 11 02 __	1. (01=Eng 1, 02=Eng 2, 03=Eng 3) EPR tape or digital readout sticks. 2. 77-11-00 Fig. 103 Block 11
77 11 03 __	1. (01=ENG 1, 02=ENG 2, 03=ENG 3) EPR tape and vernier differ. R 2. 77-11-00 Fig. 103 Block 17
77 11 04 __	1. (01=ENG 1, 02=ENG 2, 03=ENG 3) EPR set counter or bug inoperative. 2. 77-11-00 Fig. 103 Block 17
77 11 05 __	1. (01=ENG 1, 02=ENG 2, 03=ENG 3) EPR indicator completely inoperative. 2. 77-11-00 Fig. 103 Block 1
77 12 01 __	1. (01=ENG 1, 02=ENG 2, 03=ENG 3) N1 RED/WHITE/OFF flag appears. 2. 77-12-00 Fig. 103 Block 9
77 12 02 __	1. (01=Eng 1, 02=Eng 2, 03=Eng 3) N1 overspeed warning light fails to reset. 2. 77-12-00 Fig. 103 Block 10

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
77 12 03 __	1. (01=ENG 1, 02=ENG 2, 03=ENG 3) N1 tape sticks. 2. 77-12-00 Fig. 103 Block 14
77 12 04 __	1. (01=ENG 1, 02=ENG 2, 03=ENG 3) N1 reads (high, low or fluctuates). 2. 77-12-00 Fig. 103 Block 7
77 12 05 00	1. NOT USED.
77 12 06 00	1. NOT USED.
77 12 07 __	1. (01=ENG 1, 02=ENG 2, 03=ENG 3) N3 RED/WHITE/OFF flag appears. 2. 77-12-00 Fig. 103 Block 9
77 12 08 __	1. (01=ENG 1, 02=ENG 2, 03=ENG 3) N2 overspeed pointer fails to reset. 2. 77-12-00 Fig. 104 Block 9
77 12 09 __	1. (01=ENG 1, 02=ENG 2, 03=ENG 3) N2 pointer sticks. 2. 77-12-00 Fig. 104 Block 13
77 12 10 __	1. (01=ENG 1, 02=ENG 2, 03=ENG 3) N2 reads (high, low, or fluctuates) 2. 77-12-00 Fig. 104 Block 6
77 12 11 00	1. NOT USED.
77 12 12 __	1. (01=ENG 1, 02=ENG 2, 03=ENG 3) N2 indicator does not test. 2. 77-12-00 Fig. 104 Block 8

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
77 12 13 __	1. (01=Eng 1, 02=Eng 2, 03=Eng 3) N3 overspeed warning light fails to reset. 2. 77-12-00 Fig. 103 Block 10
77 12 14 __	1. (01=ENG 1, 02=ENG 2, 03=ENG 3) N3 tape sticks. 2. 77-12-00 Fig. 103 Block 14
77 12 15 __	1. (01=ENG 1, 02=ENG 2, 03=ENG 3) N3 reads (high, low, or fluctuates). 2. 77-12-00 Fig. 103 Block 7
77 12 16 00	1. NOT USED.
77 12 17 00	1. NOT USED.
77 12 18 00	1. NOT USED.
77 12 19 __	1. (01=ENG 1, 02=ENG 2, 03=ENG 3) no indication of N1 rotation before 35% N3 during start. All other indications show light-up occurred. (Ref. Chapter 80 for Fault Code diagram.) 2. 77-12-00 Fig. 105 Block 6
77 12 20 __	1. (01=ENG 1, 02=ENG 2, 03=ENG 3) no indication of N2 rotation before 35% N3 during start. All other indications show light-up occurred. (Ref. Chapter 80 for Fault Code diagram.) R 2. 77-12-00 Fig. 104 Block 6
77 12 21 __	1. (01=ENG 1, 02=ENG 2, 03=ENG 3) N2 indicator pointer inoperative. 2. 77-12-00 Fig. 104 Block 1
77 12 22 00	1. NOT USED.
77 12 23 00	1. NOT USED.
77 12 24 00	1. NOT USED.

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
77 12 25 00	1. NOT USED.
77 12 26 __	1. (01=ENG 1, 02=ENG 2, 03=ENG 3) N2 overspeed pointer does not move with gauge pointer above 95% N2. 2. 77-12-00 Fig. 104 Block 6
77 13 01 00	1. Selected mode switchlight out on RATED EPR MODE control panel. All other indications normal. 2. 77-13-00 Fig. 106 Block 1
77 13 02 00	1. Rated EPR does not agree with EPR chart. 2. 77-13-00 Fig. 103 Block 5
77 13 03 00	1. Selected mode not ann on RATED EPR indicator. All other ind normal. 2. 77-13-00 Fig. 104 Block 1
77 13 04 00	1. RATED EPR and TAT flags in view on RATED EPR ind. All other ind normal. 2. 77-13-00 Fig. 105 Block 4
77 13 05 00	1. RATED EPR flag in view on RATED EPR ind. All other ind normal. 2. 77-13-00 Fig. 105 Block 3
77 13 06 00	1. RATED EPR flag in view on RATED EPR ind and MACH flag in view on F/O AIRSPEED/MACH ind. 2. 77-13-00 Fig. 104 Block 7
77 13 07 00	1. Rated EPR and/or TAT ind sticks or unstable. All other ind normal. 2. 77-13-00 Fig. 103 Block 4

FAULT CODE INDEX
TABLE 1 (CONTINUED)

FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
77 14 01 00	1. ENGINE 2 FAIL-ARMED light on, flaps within takeoff range, N2 below 83%.
	2. 77-14-00 Fig. 103 Block 9
77 14 02 00	1. ENGINE 2 FAIL-ARMED light off, flaps within takeoff range, N2 above 83%.
R	2. 77-14-00 Fig. 103 Block 1
77 14 03 00	1. ENG 2 FAIL light on, flaps not within takeoff range, ENGINE 2 FAIL-ARMED light on, and N2 above 83%.
	2. 77-14-00 Fig. 103 Block 12
77 21 01 __	1. (01=ENG 1, 02=ENG 2, 03=ENG 3) TGT RED/WHITE/OFF flag appears.
	2. 77-21-00 Fig. 103 Block 12
77 21 02 __	1. (01=Eng 1, 02=Eng 2, 03=Eng 3) TGT overtemp warning light fails to reset.
	2. 77-21-00 Fig. 103 Block 12
77 21 03 __	1. (01=Eng 1, 02=Eng 2, 03=Eng 3) TGT tape sticks.
	2. 77-21-00 Fig. 103 Block 12
77 21 04 00	1. NOT USED.
77 21 05 00	1. NOT USED.
77 21 06 00	1. NOT USED.
77 21 07 __	1. (01=ENG 1, 02=ENG 2, 03=ENG 3) no indication of TGT rise within 30 seconds of FUEL AND IGNITION switch selected ON. All other indications show light-up occurred.
	2. 77-21-00 Fig. 103 Block 8

FAULT CODE INDEX
TABLE 1

	FAULT CODE	1. LOG BOOK REPORT 2. FAULT ISOLATION REFERENCE
	77 21 08 __	1. (01=ENG 1, 02=ENG 2, 03=ENG 3) TGT indication fluctuates.
		2. 77-21-00 Fig. 103 Block 8
R	77 22 01 __	1. (01=ENG 1, 02=ENG 2, 03=ENG 3) OVHT light on when test switch "A" is pressed.
R		2. 77-22-00 Fig. 103 (Sheet 1) Block 4
R	77 22 02 __	1. (01=ENG 1, 02=ENG 2, 03=ENG 3) OVHT light on when test switch "B" pressed.
R		2. 77-22-00 Fig. 103 (Sheet 2) Block 6

ENGINE INDICATING - DESCRIPTION AND OPERATION

1. General

Indicating systems for engine operating conditions described in this chapter are grouped under Power, Temperature, and Analyzers headings. Two systems comprise the power group: the integrated engine pressure ratio (IEPR) system and the engine shaft speed system. The temperature group consists of a turbine gas temperature (TGT) system to monitor exhaust gas temperatures and an engine cooling air overheat indicating system. The analyzers group consists of a vibration monitoring system which warns of any engine imbalance or bearing roughness.

Each indicating system is composed of the necessary probes, analyzers, transmitters, and indicators to provide continuous readings of engine performance. The three independently rotating engine modules are monitored for speed conditions. Indicators for low-pressure (N1) and high-pressure (N3) modules are located on the pilots center instrument panel, zone 210. Intermediate-pressure (N2) module indicators are located on the Flight Engineer/Second Officers ENGINE STATUS panel, zone 215. The EPR indicators and the TGT indicators comprise the balance of engine monitoring instruments located on the pilots center instrument panel. Vibration monitoring indicators are located
R only on the ENGINE STATUS panel.

R Three engine turbine air overheat (TURB AIR OVHT ENG 1/2/3)
R indicator lights are located on the pilots CAWP in the center
R instrument panel. These red lights warn the Captain and First
R Officer of excessive temperatures in the turbine module. An ENGINE TURB COOLING AIR panel at the Flight Engineer/Second Officers station provides similar temperature warning indications and a test capability.

POWER - DESCRIPTION AND OPERATION

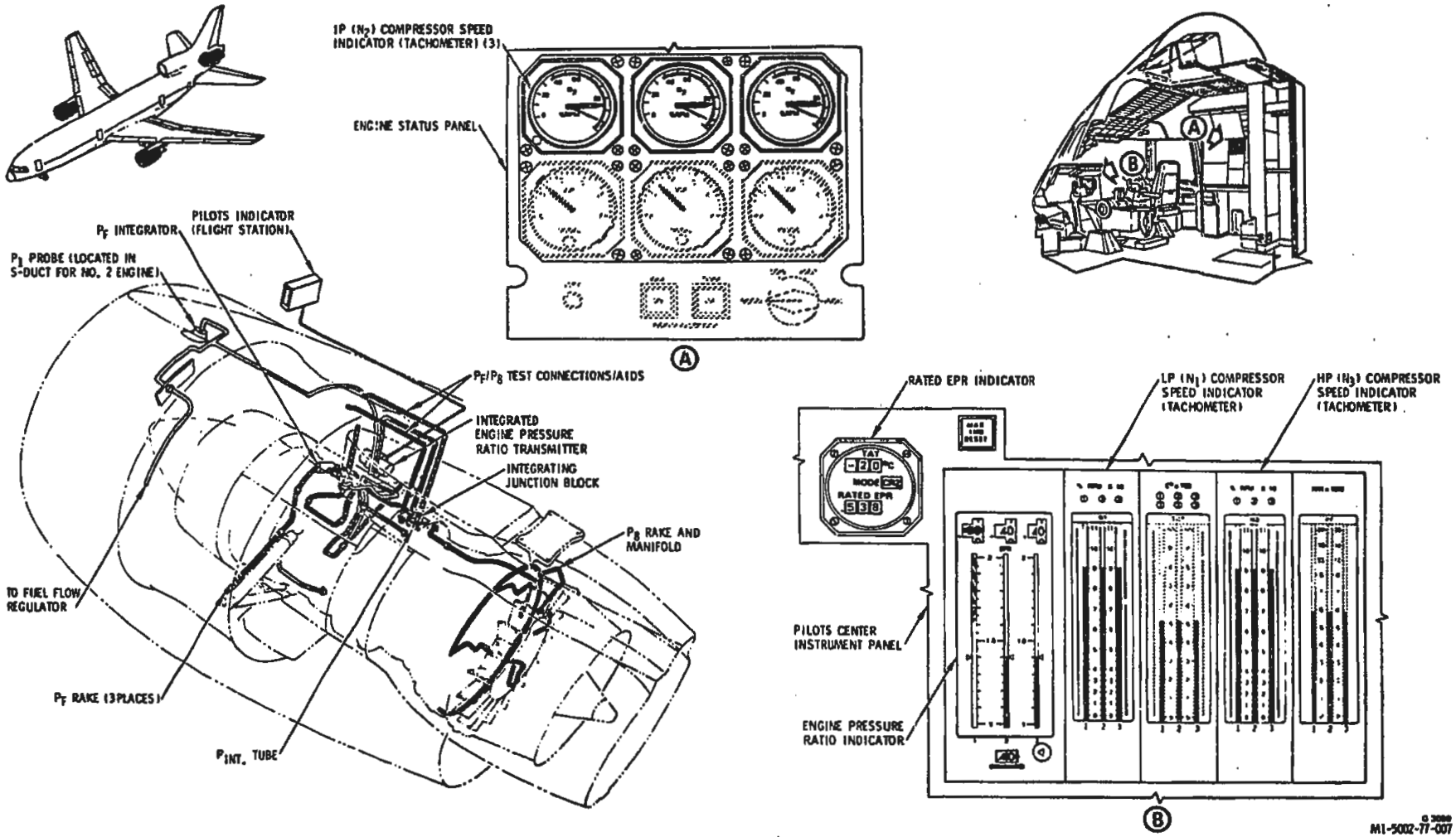
1. General

The integrated engine pressure ratio (IEPR) system and the engine shaft speed indicating system provide the flight crew with the major engine power performance indications.

The IEPR system consists of a single triple-scale, vertical-tape indicator; three transmitters; probes located in each engine nose cowl (and the S-duct), and a series of probes and rakes located aft of the low-pressure compressor (fan), and aft of the turbine section. Intake air pressure (P1) and a total fan exhaust and turbine exhaust integrated pressure (P INT) are sensed and routed to the transmitter for each engine. The electrical signals to each indicator are conditioned in the transmitters to drive the tape and digital display (Ref. Fig. 1).

All three separately rotating compressor/turbine shafts in each engine are monitored continuously for revolutions per minute (rpm), which are expressed as percentages of the design rotational speeds. The low-pressure (N1) compressor module rpm and the high-pressure (N3) module rpm, as sensed by a phonic wheel probe and a tachometer generator, are displayed on two triple-tape, vertical-scale indicators located on the pilots center instrument panel, zone 210.

Intermediate-pressure (N2) compressor module shaft speed readings, as sensed by a probe, are transmitted to three analog (pointer) indicators located on the Flight Engineer/Second Officers ENGINE STATUS panel, zone 215.



Engine Power Indicating System
Figure 1

EFFECTIVITY: ALL

INTEGRATED ENGINE PRESSURE RATIO INDICATING SYSTEM DESCRIPTION AND OPERATION

1. General

The integrated engine pressure ratio indicating system uses the ratio of integrated engine exhaust pressure to air intake pressure to provide an indication of engine thrust at the flight station (Ref. Fig. 1).

The integrated engine exhaust pressure, comprising signals from both the hot and cold thrust streams, and also engine intake pressure are fed to a transmitter from which electrical signals are passed to the indicator and displayed as units of EPR (Ref. Fig. 2).

Components of the IEPR system include the following:

One inlet pressure (P1) probe located in each engine nose cowl and in the center of the S-duct (Ref. 73-21-00)

Three anti-icedlow-pressure (LP) fan pressure (PF) rakes per engine. One is located in the splitter leading edge, and one is located on each of the A-frame structures

Five high-pressure (P8) rakes located in 5 of the 18 rotor tail bearing supports per engine

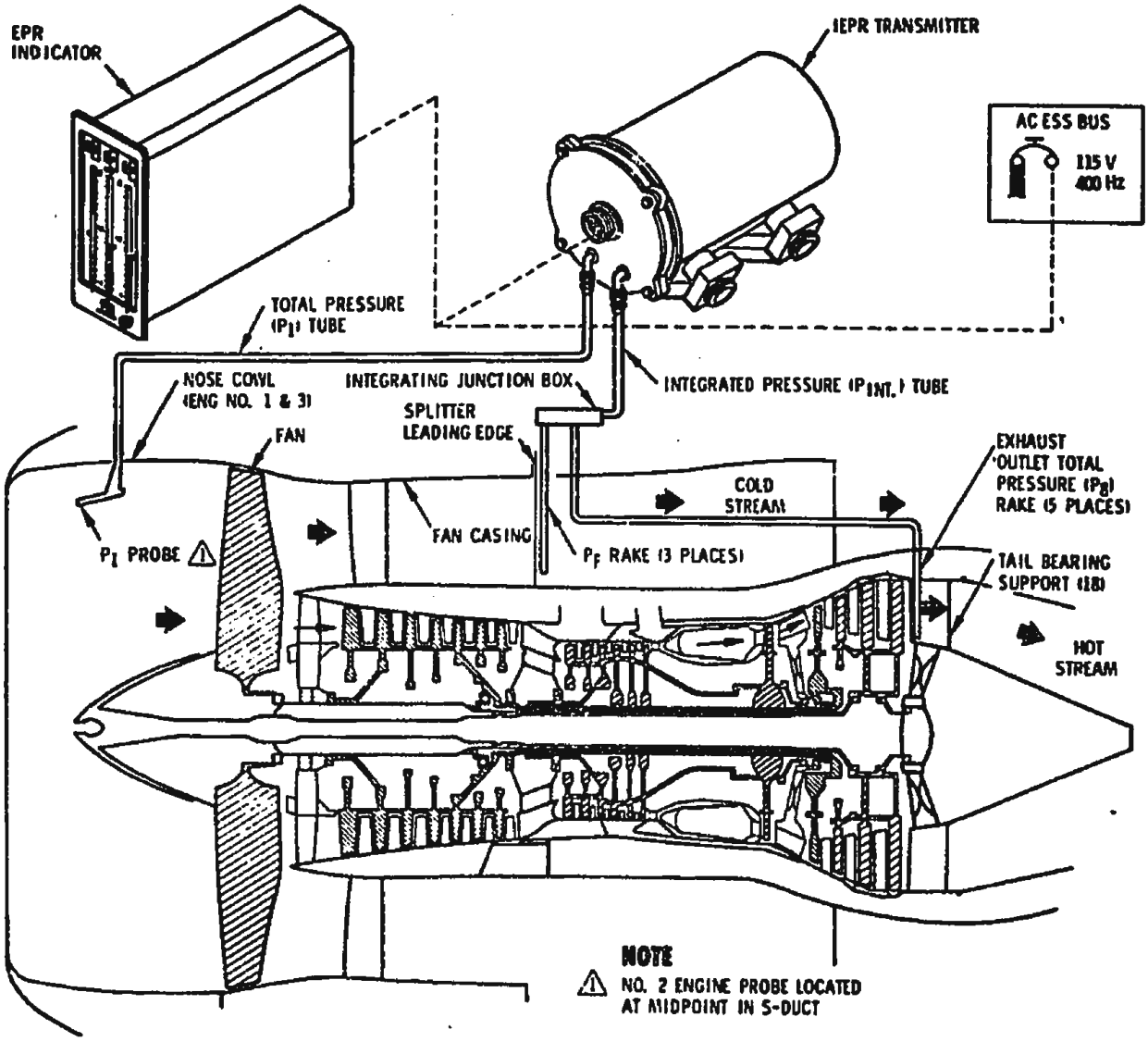
One integrating multiple connector for PF and P8 pressures on each engine (Ref. Fig. 3)

One pressure ratio transmitter for each engine (Ref. Fig. 4)

Trimmer Unit (engines incorporating SB 77-2521)

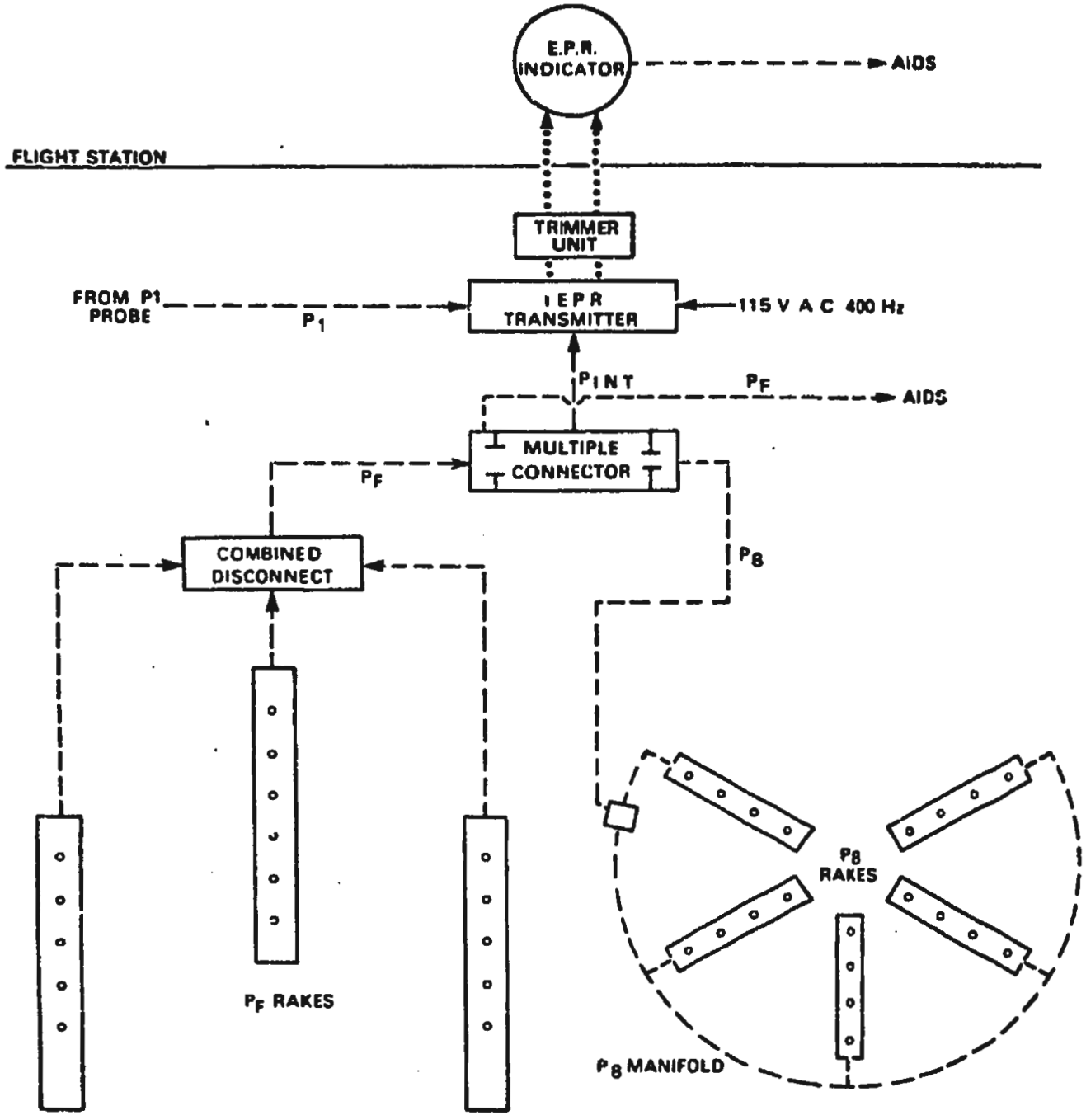
One vertical-scale EPR indicator mounted on the pilots center instrument panel, zone 210

A signal of air intake pressure (P1), tapped from the sensing probe supply (Ref. 73-21-00), is fed to the IEPR transmitter. Signals of LP compressor exhaust pressure (PF) and gas generator exhaust pressure (P8), sensed by the rakes, are fed to the multiple connector where they are integrated and the resultant pressure (P INT) passed to the transmitter. The transmitter converts the pressure signals to an electrical signal which together with a fixed dc reference voltage, is fed to and processed by the EPR indicator to provide both an analogue and digital display in units of EPR (Ref. Fig. 5). The indicator also provides a signal of EPR to the aircraft integrated data system (AIDS).

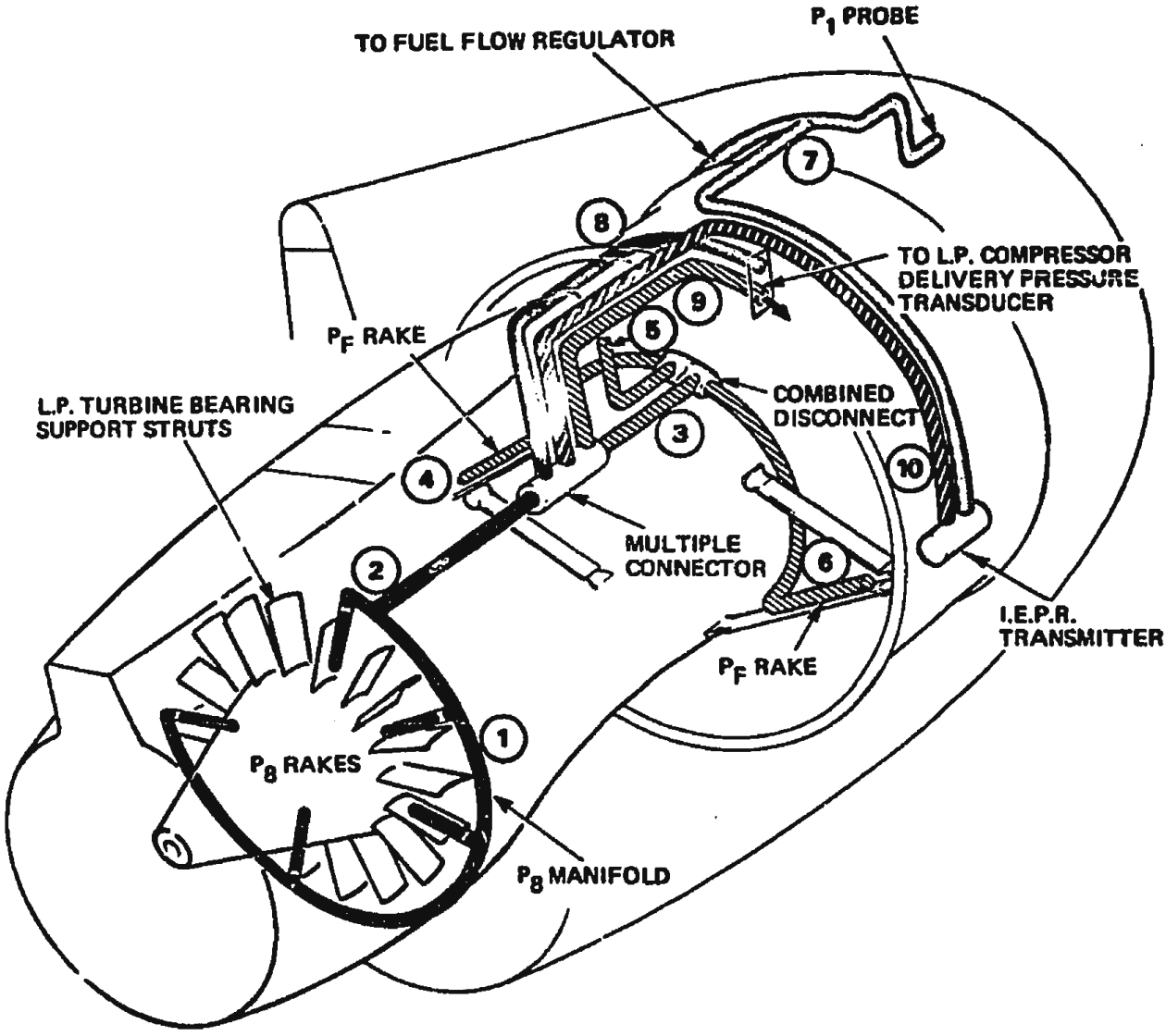


HH 6122
M1-5102-77-008

Integrated Engine Pressure Ratio System
Figure 1



IEPR System Diagram
Figure 2



ALL EXTERNAL TUBES ARE NUMBERED FOR REFERENCE TO FIG. 4

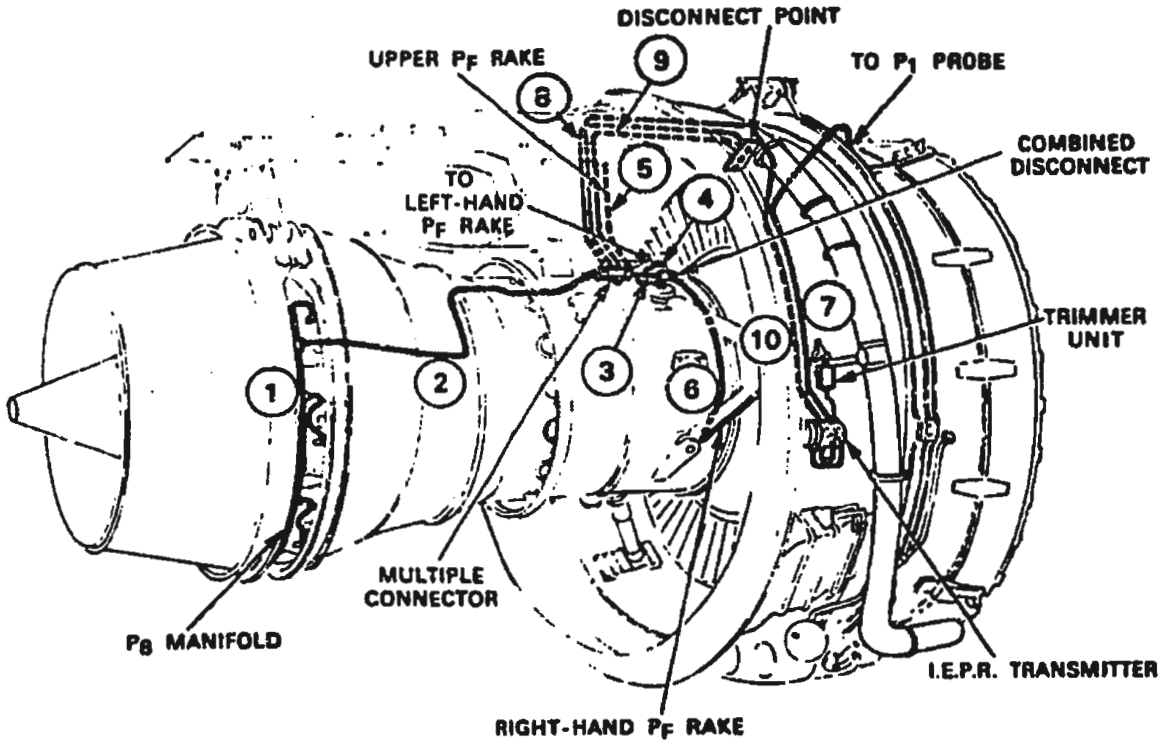
- AIR INTAKE PRESSURE (P_1)
- L.P. COMPRESSOR OUTLET PRESSURE (P_F)
- EXHAUST PRESSURE (P_8)
- INTEGRATED PRESSURE (P_{INT})

25407A
M1-5001-77-076

R
R

IEPR System Arrangement
Figure 3

EFFECTIVITY: ALL



All external tubes are numbered for reference to fig. 3

HH 9198
M1-0101-77-071
238578

IEPR System External Units and Tubes
Figure 4

On engines incorporating SB 77-2521, the electrical signals from the transmitter are fed to a trimmer unit and then to the indicator. The function of the trimmer unit is to reduce scatter in the relationship between indicated EPR and engine thrust so that it is unique for all engines.

2. Integrated Engine Pressure Ratio Transmitter

A. Description

The integrated engine pressure ratio transmitter (Ref. Fig. 6), located in zones 412, 422 and 432, is positioned on the right side of the LP compressor case and converts air pressure signals to an electrical signal that is fed to an indicator at the flight station.

The transmitter basically comprises a cylindrical case containing a transducer, a 2-phase servomotor, a gear train, and a variable potentiometer. The case, positioned on antivibration mounts in a cradle assembly, accommodates a detachable end cover containing the air pressure connectors (P1 and P INT) and an electrical receptacle.

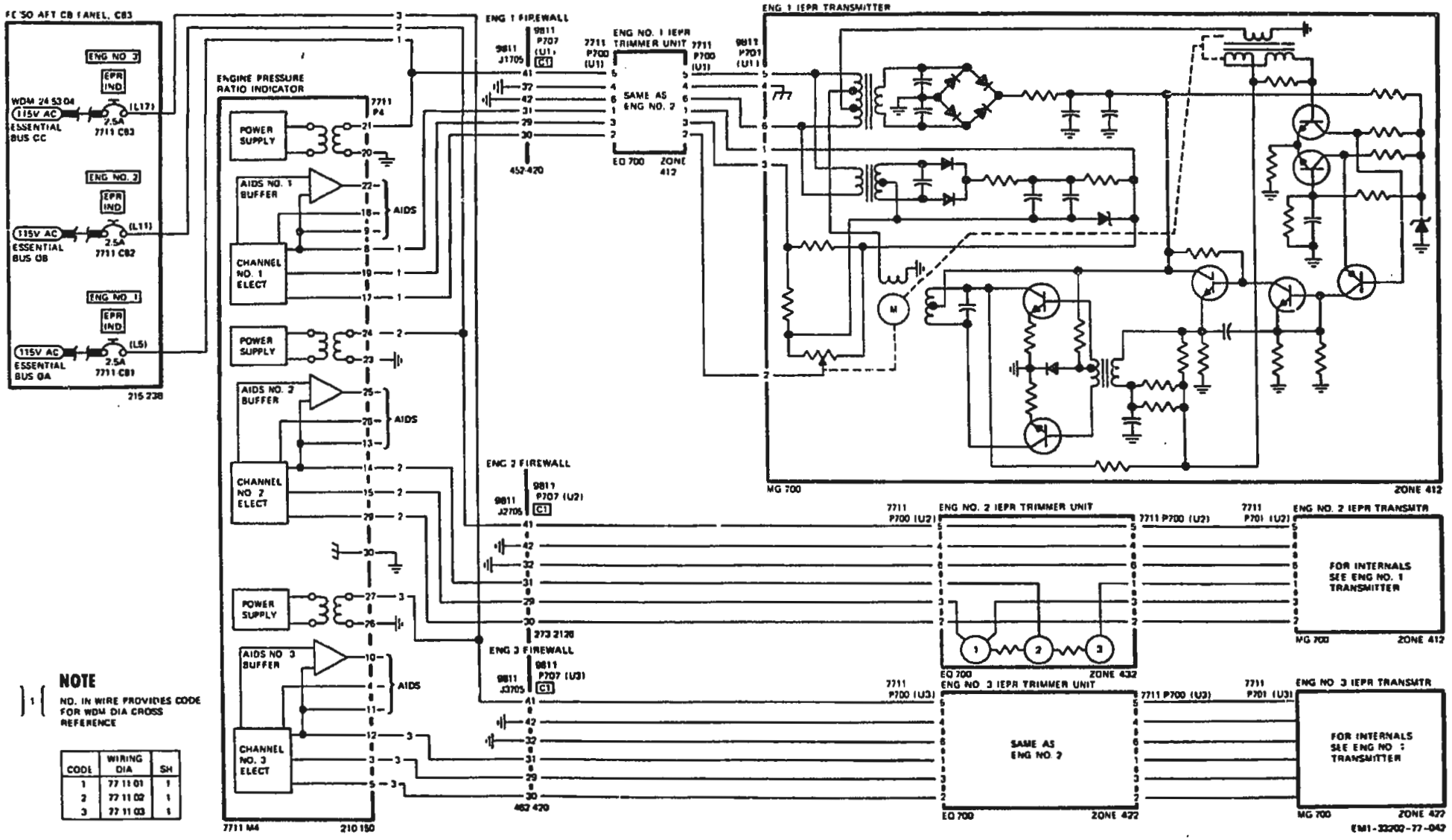
The transducer comprises two pairs of capsules mounted in a frame such that one pair, internally pressurized by P1 and P INT, respectively, is opposed to the other pair, one of which is internally pressurized by P1 and the other evacuated. The frame is encircled by a gimbal which, in
R turn, is positioned in a yoke. The yoke pivots about axis
R A-A and is supported together with the capsule assembly, by
R a center shaft.

R A linear variable differential transformer (LVDT), whose
R core is attached to the yoke and stator to the gimbal
R converts the mechanical movement sensed by the yoke into an
R electrical signal. The signal is fed to the servo motor
R which is connected, through gears, to the gimbal and also
R the potentiometer. The potentiometer provides the two dc
R voltage signals for the EPR indicator.

B. Operation

Change in pressure within the system is sensed by the transducer capsules (Ref. Fig. 7) which deflect the center shaft causing the yoke to pivot about axis A-A.

This movement is sensed by the LVDT and converted to an ac electrical signal which is amplified and applied to the control winding of the servomotor.



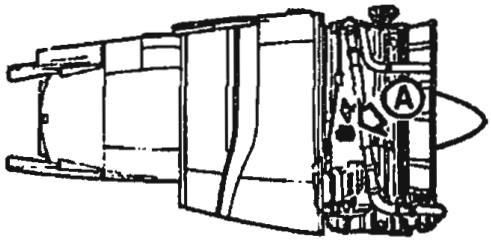
NOTE

1 { NO. IN WIRE PROVIDES CODE FOR WDM DIA CROSS REFERENCE

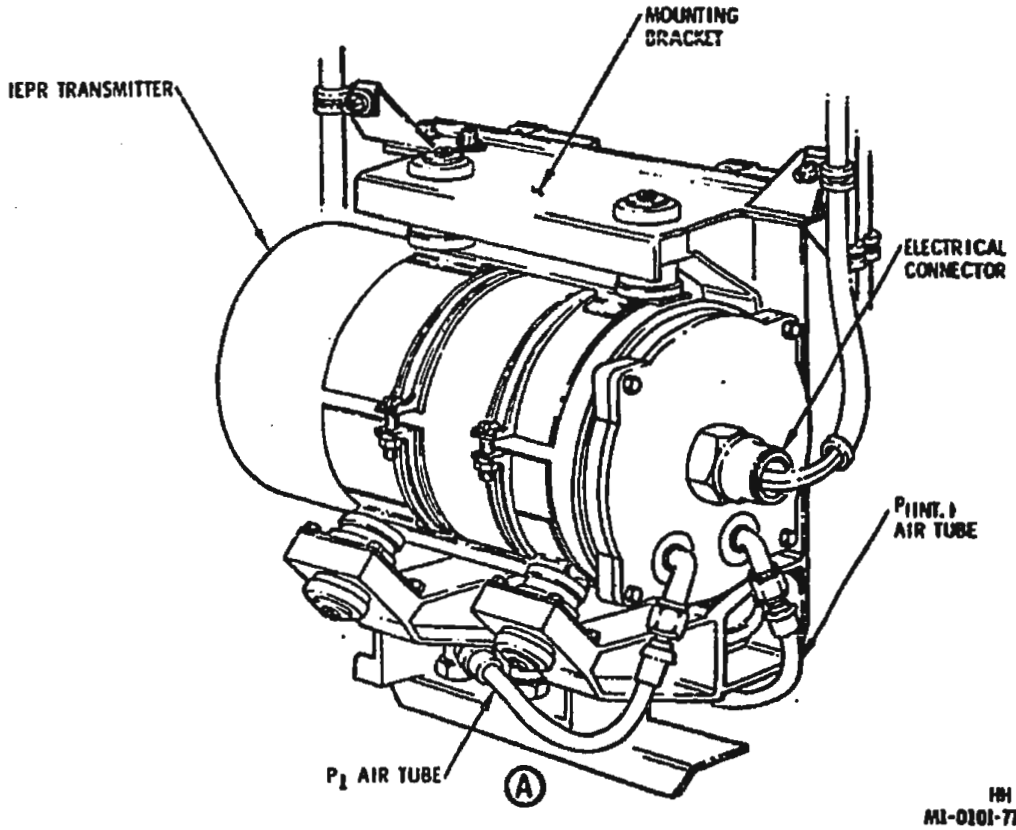
CODE	WIRING DIA	SH
1	77 11 01	1
2	77 11 02	1
3	77 11 03	1

R IEPR Indicating System Schematic
R Figure 5

EFFECTIVITY: ALL



ZONE 412, 422, OR 432



IEPR Transmitter
Figure 6

The motor, through the gears, alters the potentiometer output voltage signal to the indicator and simultaneously drives the gimbal in the same direction as the initial yoke movement until the LVDT signal to the motor is cancelled and the system stabilized at the new setting.

3. Engine Pressure Ratio Indicator

A. Description

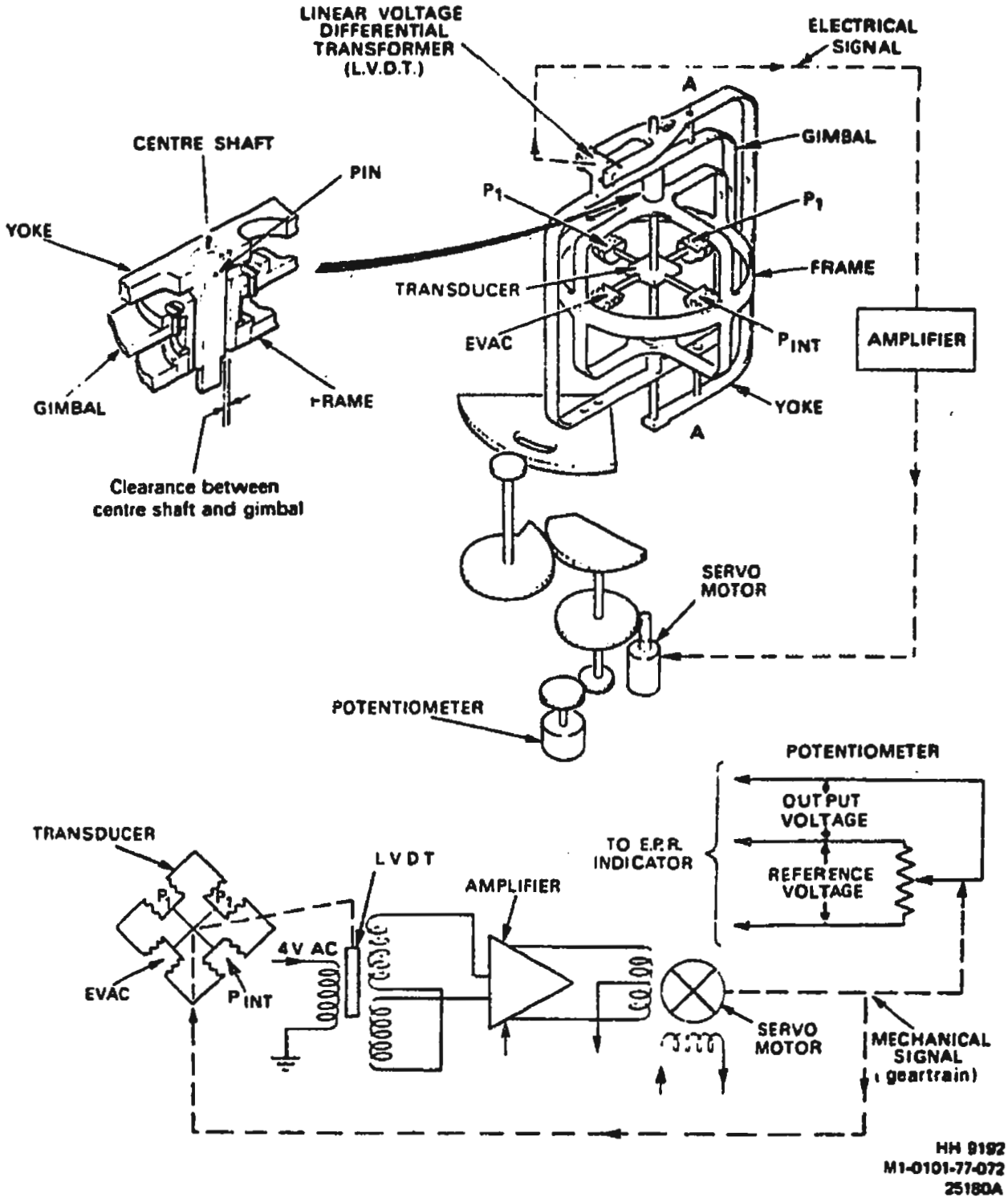
A single three-scale, vertical-tape, engine pressure ratio (EPR) indicator is located on the left side of the pilots center instrument panel, zone 210. The three tape-indicator scales provide an analog readout of the thrust performance of the three engines. Corresponding digital (counter) displays are located near the top of the indicator scale plate. These displays provide a two-digit decimal readout. Tape displays indicate the ratio of engine inlet pressures (P1) to integrated bypass fan (cold stream) and hot stream exhaust pressures (P INT). The digital readouts are provided on magnetically positioned counter wheels(Ref. Fig. 8).

The multiscale indicator consists of a bevel-edge case, a scale plate, a cursor set knob (index set), four digital wheel sets, and three analog scale tapes. Three dc torquers drive the woven-glass tapes. The amplifier output energizes the torquer field coils. Tape bands are marked with white and black sections. A red segment contains an OFF legend. Signal-conditioning electronic components are located in the case. All circuitry is packaged on replaceable, plug-in printed circuit boards. The indicator is not hermetically sealed. Wedge lighting provides uniform illumination of the scales. Lamps are replaceable from the front of the indicator without removing or opening the case.

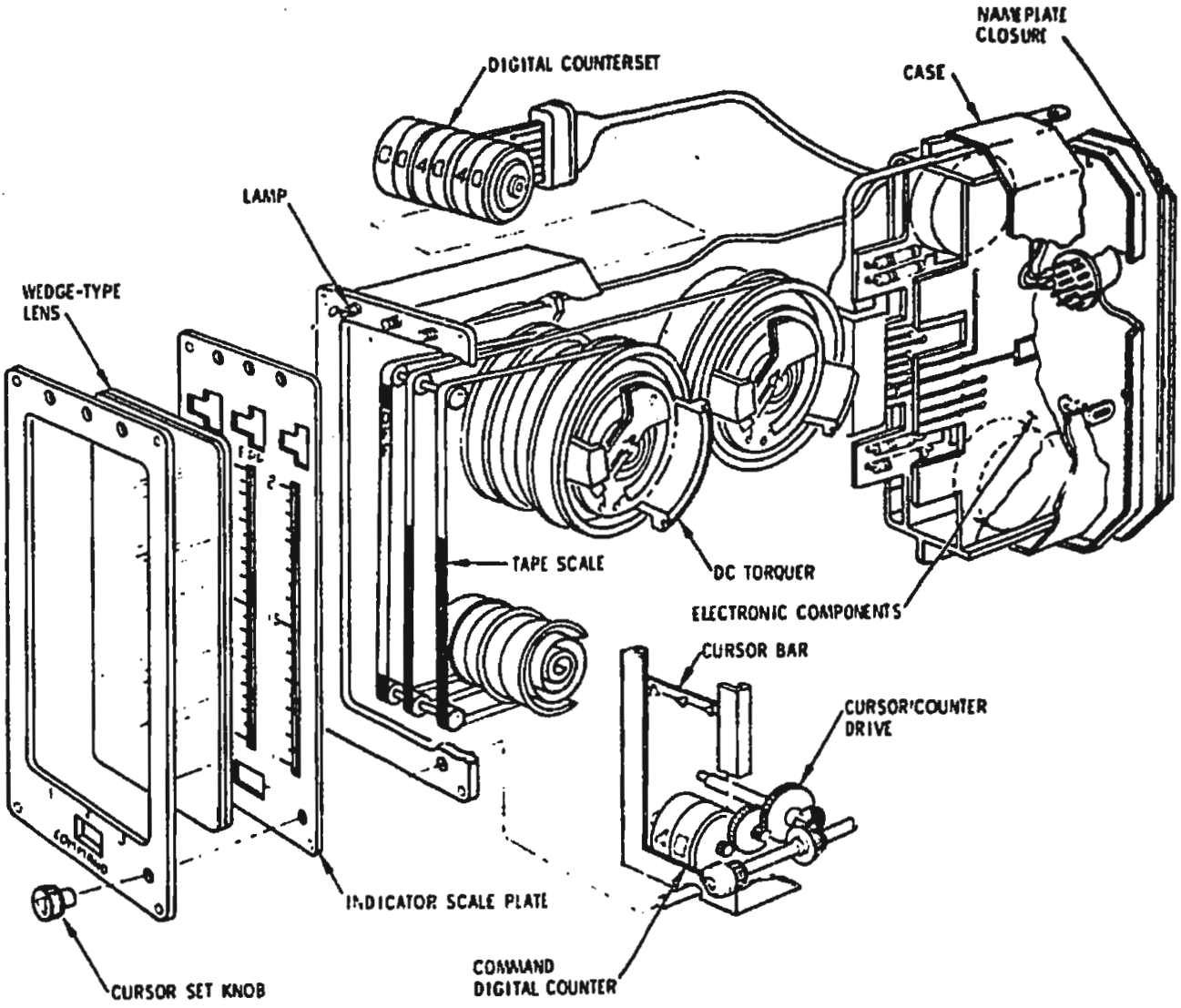
Three sets of two counter wheels provide the digital display. Solid-state logic is used to energize the coils that drive the permanent magnets attached to the wheels. Magnetic shielding prevents interaction of the various wheels. Command wheel setting is by a gear drive. One small cursor (pointer) for each tape scale is positioned in direct ratio to the COMMAND digital wheel setting. A built-in-test-equipment (BITE) circuit has been provided to interrogate the indicator whenever an indicator or system malfunction is suspected.

B. Operation

The EPR indicator operates on 115V, 400-Hz power (Ref. Fig. 9). Electrical impulses (in the form of



IEPR Transmitter Operation
Figure 7



A11-0002-77-010

EPR Indicator
Figure 3

binary-coded-decimal data) are received from the transmitter. This data is converted to continuously repeated cycles (two per second) by the indicator electronics to reposition the tape and digital readouts. In normal operation, with the integrated engine pressure ratio established exactly at the predetermined COMMAND value, the line created by the juncture of white and black tape bands will be aligned with the cursor. If the EPR falls below this value, movement of the tape will reduce the black area exposed. An increase in EPR would reduce the white area exposed. The red OFF section of the tape will not come into view for off-scale values of EPR as low as 1.00 during throttle-back landing conditions.

R Loss of electrical power will cause a system integrity
R monitor to position the tape displaying the word OFF. The malfunction indication threshold is set at 0.70 EPR to avoid appearance of a malfunction warning during aircraft descent when developed EPR may be less than 1.00. No normal operation is expected to produce a value exceeding 1.99. The malfunction flag will appear at any value in excess of 1.99. Respective tape color will be all white or all black.

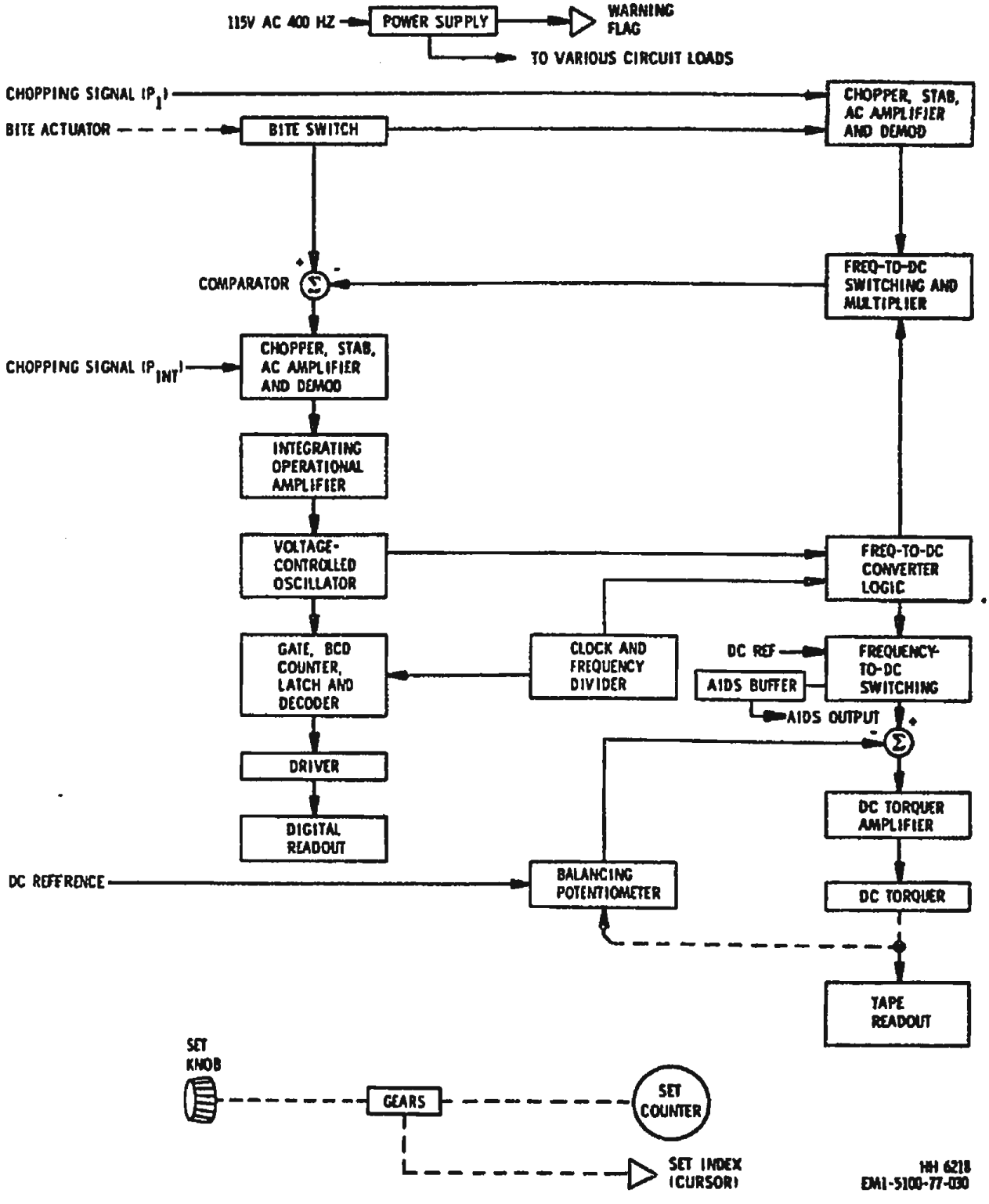
The EPR indicator provides a signal to the aircraft integrated data system (AIDS) recorder.

4. PF Rake, Multiple Connector and Tubes

A. Description and Operation

Three PF rakes, located in zones 412, 422 and 432, are fitted to the engine. One is positioned on the upper strut of the left-hand LP compressor case support assembly, one on the lower strut of the right-hand LP compressor case support assembly, and one in the nose section of the pylon splitter fairing. Each rake comprises two concentric tubes. The LP compressor exhaust pressure (PF) enters the inner tube through forward facing inlets. Drain holes at each rake position prevent the accumulation of water. The three rakes are connected by rigid tubes, incorporating bolted end connectors, to a combined disconnect on top of the intermediate compressor case. The combined disconnect provides a mean PF signal which is then passed by a rigid tube to a multiple connector positioned on the upper right side of the intermediate case.

The multiple connector, which functions as a pressure splitter, also accepts a rigid tube from the P8 manifold. Restrictors in the multiple connector control the flow of PF and P8 in proportion to the areas of the LP compressor and turbine exhausts. The resultant integrated pressure (P INT)



EPR Indicator Block Diagram
Figure 9

is passed through a rigid tube to the transmitter. Rigid tubes next to the multiple connector inlets are routed to a disconnect point at the upper right-hand side of the LP compressor case. The tubes from the multiple connector accommodate nut and nipple end connectors.

5. P8 Rake and Manifold

A. Description and Operation

Five P8 rakes, located in zones 412, 422 and 432, are fitted to the engine. Each rake, located in the leading edge of an LP turbine bearing support strut, senses gas generator exhaust pressure (P8) through forward-facing inlets in each strut.

Each rake is connected by a short tube to a rigid two-piece manifold secured to the exhaust case. The manifold is connected via a three-way connector and a rigid tube to the multiple connector.

6. Integrated Engine Pressure Ratio (IEPR) Trimmer Unit and Harness

A. Description and Operation

The integrated engine pressure ratio trimmer unit (Ref. Fig. 4), located in zones 412, 422 and 432, is positioned on the right side of the LP compressor case.

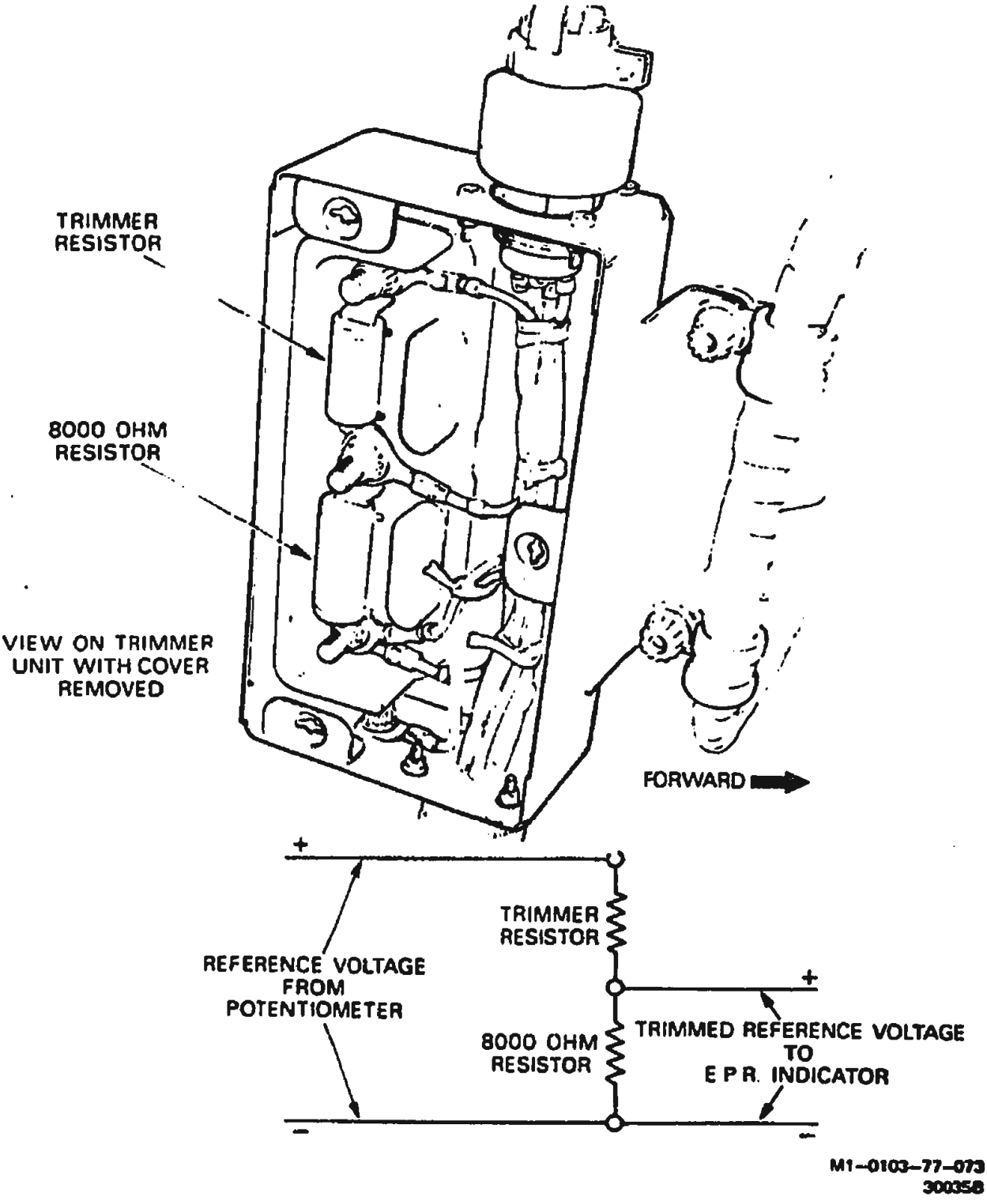
The trimmer unit (Ref. Fig. 10) basically comprises a terminal block assembly housed in a metal case which has a detachable cover. One end of the case accommodates an electrical receptacle that connects to the engine light duty electrical harness (Ref. 71-50-00). A short harness passes through the opposite end of the case and connects to the transmitter.

A resistor of fixed value (8000-ohm) and a trimmer resistor whose value is selected from a range of resistors to suit the individual engine characteristics, are fitted in the terminal block. The code letter of the trimmer resistor fitted is stamped on the engine data slip plate.

The resistors form a potential divider system in the reference voltage circuit between the transmitter and indicator, thereby trimming (reducing) the reference signal voltage to set a unique EPR for a given thrust.

The 8000-ohm resistor has terminal holes of different diameters and the trimmer resistor has terminal holes of the

same diameter, to mate with the terminal posts in the terminal block.



IEPR Trimmer Unit
Figure 10

INTEGRATED ENGINE PRESSURE RATIO (IEPR) - FAULT ISOLATION

1. General

The fault isolation diagrams in this section can be used for fault isolation any time a fault is reported or suspected. Before fault isolation is started, the PREREQUISITES listed on the diagram must be fulfilled.

If the flight crew reports a trouble using a FIRM Fault Code number, the number can be found in the FIRM Fault Code Cross Reference Table in the Chapter 77-INDEX.

The FIRM Fault Code Cross Reference Table includes the flight report (fault symptoms) and the exact Section, Figure, Sheet, and Block number where fault isolation should begin. (Refer to the L-1011 Maintenance Manual Introduction for a more detailed explanation on the use of fault isolation diagrams.)

If a fault is reported or suspected and no FIRM Fault Code is available, the function or fault indication can be found in the table below. When a diagram is selected in this manner fault isolation is started at Block 1.

2. Fault Isolation/Identification

Table 101 is a list of fault isolation data in this section of the manual.

Fault Isolation Data
Table 101

FIGURE	TITLE
101	Component Locator Index
102	Component Locator
103	IEPR Indicating Fault Isolation
SCHEM 1	IEPR Indicating System Circuits

CR 3. L-1011 - RB211 Engine EPR System Tolerance.

CR A. During January, 3 engines were removed due to reported low
CR EPR. The first of these engines has been checked in the
CR test cell and the EPR system was found to be satisfactory.

CR This follows a pattern which we have seen in the past where
CR engines removed for low EPR are in fact not low. It results
CR from aligning engine parameters other than EPR.

CR B. Three factors contribute to this problem:

CR (1) Production engines, fresh from repair and test, exhibit
CR scatter in all parameters, except EPR, at fixed power
CR settings.

CR (2) The electronic portion of the EPR system (indicator and
CR transmitter) is only accurate to ± .007 EPR.

CR (3) The ability of the pressure sensing portion of the EPR
CR system (P8 probes, Pf probes, integrator block, etc.)
CR to deliver the correct signal to the transmitter is
CR accurate to ± .003.

CR C. When these 3 factors are considered, the following parameter
CR spreads, between engines at the same power (EPR), are
CR possible:

CR	N1	1.6%
CR	TGT	18°C
CR	Fuel Flow	640 pph
CR	N3	1.2%

CR D. If an attempt is made to align these parameters, not
CR recognizing that this spread is reasonable, a .026 spread in
CR EPR results.

CR E. In view of the above, the following procedure is established
CR for handling low EPR writeups:

CR (1) If EPR is written up as reading low by .026 or less,
CR sign off remark, "Within acceptable limits per
CR Maintenance Manual 77-11-00". Send message to MCIEE,
CR 1-408 listing aircraft, engine position, and amount it
CR is low.

CR (2) If EPR is written up as reading low by more than .026,
CR contact MCIMD since this is a designated MEL item. The
CR coordinator will establish the following corrective
CR action:

CR NOTE: Anytime a problem is found and corrected, the
CR balance of these checks can be omitted.

CR (a) Check calibration of all three engines per
CR Maintenance Manual 77-11-00, page 503/504. Send
CR completed sheets to MCIEE, Shirley, 1-408 MCI.

CR (b) Leak check P INT lines per Maintenance Manual
CR 77-11-00, page 505.

CR (c) Remove P8 probes and check for proper alignment,
CR broken tubes and correct length. Probe at 3
CR o'clock position is longer than others.

CR (d) Check PF rakes for forward alignment. Should be
CR plus or minus 10 degrees to fan stream.

CR (e) Remove integration block and check for obstruction
CR in orifice.

CR (f) Borescope HP and IP compressors M11-72-01 IP
CR compressor. M11-72-03 HP compressor.

CR (g) Do performance test 6. Report findings to MCIEE,
CR Shirley.

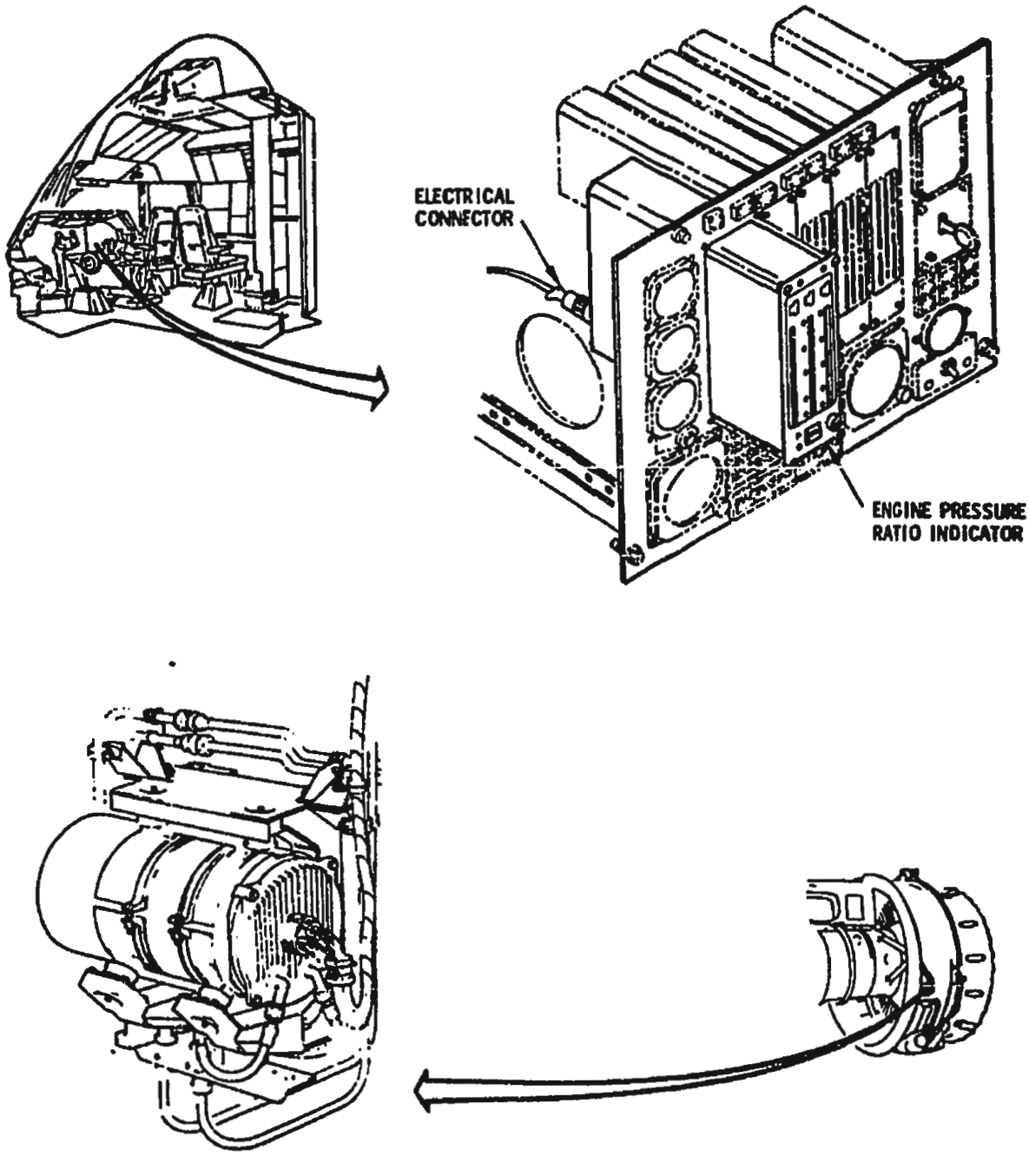
CR (3) If after the accomplishment of the foregoing checks EPR
CR continues to be written up as reading more than .026
CR low, engine may continue in service as long as no
CR operating limits are exceeded. In the event engine
CR power reduction is necessary to keep any engine
CR parameter from being exceeded, engine will be scheduled
CR for removal.

CR F. This procedure should eliminate unjustified engine removals
CR and reduce EPR indicator and transmitter removals.

COMPONENT	QTY	AREA/ACCESS	REFERENCE
EPR INDICATOR	1	FLT STA/PILOT CTR INST PNL	77-11-03
EPR TRANSMITTER			
WING ENGINES	2	ACCESSORY SECTION/RH HINGED COWL	
NO. 2 ENGINE	1	ACCESSORY SECTION/LOWER RH HINGED COWL	77-11-02

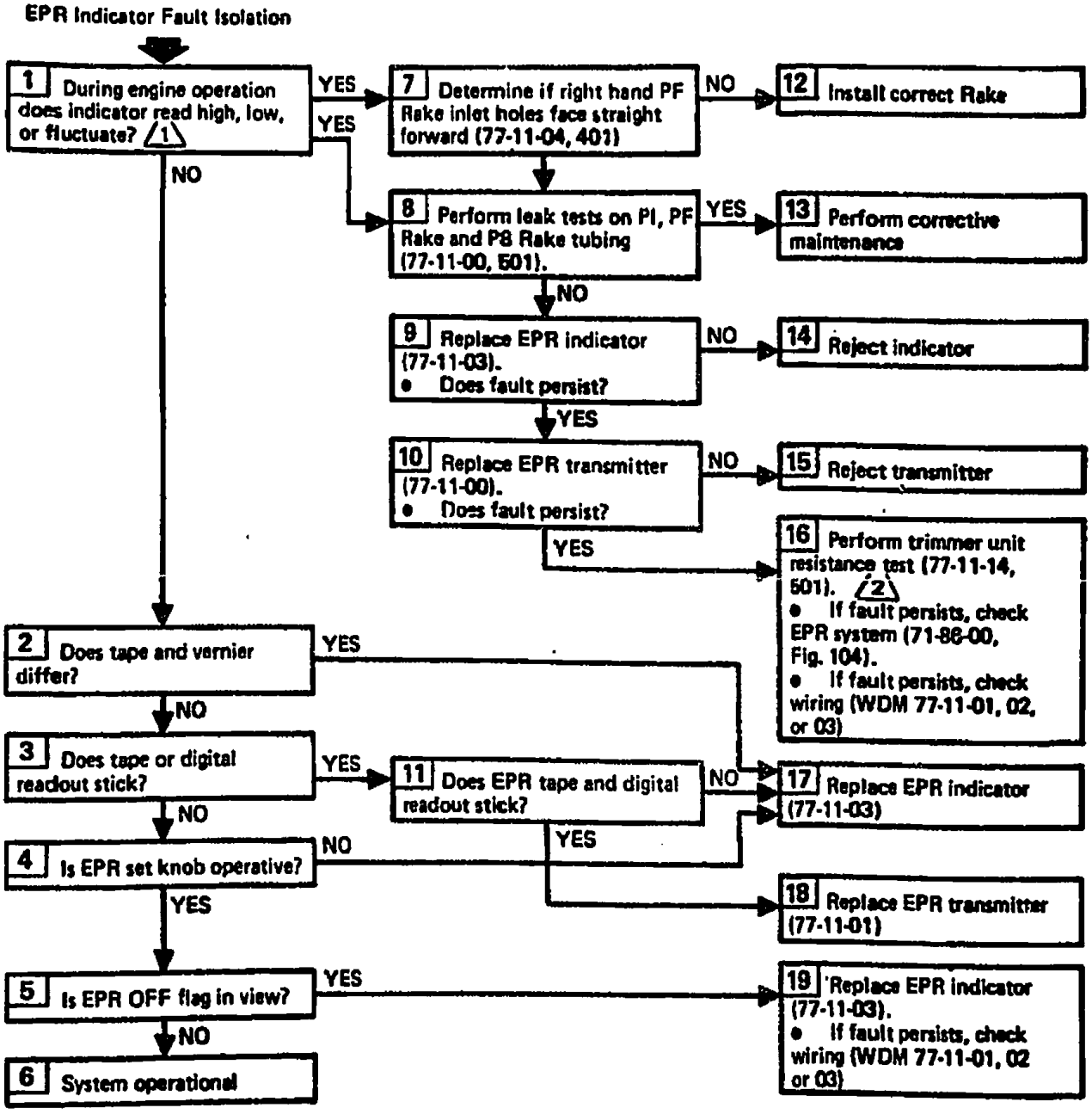
M1-0000-77-170

Component Locator Index
Figure 101



M1-0000-77-173

IEPR Indicating System Component Locator
Figure 102


EPR Indicator Fault Isolation
1 During engine operation does indicator read high, low, or fluctuate? ⚠1
YES
NO
7 Determine if right hand PF Rake inlet holes face straight forward (77-11-04, 401)
NO
12 Install correct Rake
YES
8 Perform leak tests on PI, PF Rake and P8 Rake tubing (77-11-00, 501).
YES
13 Perform corrective maintenance
NO
9 Replace EPR indicator (77-11-03).
• Does fault persist?
NO
14 Reject indicator
YES
10 Replace EPR transmitter (77-11-00).
• Does fault persist?
NO
15 Reject transmitter
YES
16 Perform trimmer unit resistance test (77-11-14, 501). ⚠2
• If fault persists, check EPR system (71-86-00, Fig. 104).
• If fault persists, check wiring (WDM 77-11-01, 02, or 03)
2 Does tape and vernier differ?
YES
NO
3 Does tape or digital readout stick?
YES
11 Does EPR tape and digital readout stick?
NO
17 Replace EPR indicator (77-11-03)
NO
YES
4 Is EPR set knob operative?
NO
18 Replace EPR transmitter (77-11-01)
YES
5 Is EPR OFF flag in view?
YES
19 Replace EPR indicator (77-11-03).
• If fault persists, check wiring (WDM 77-11-01, 02 or 03)
NO
6 System operational

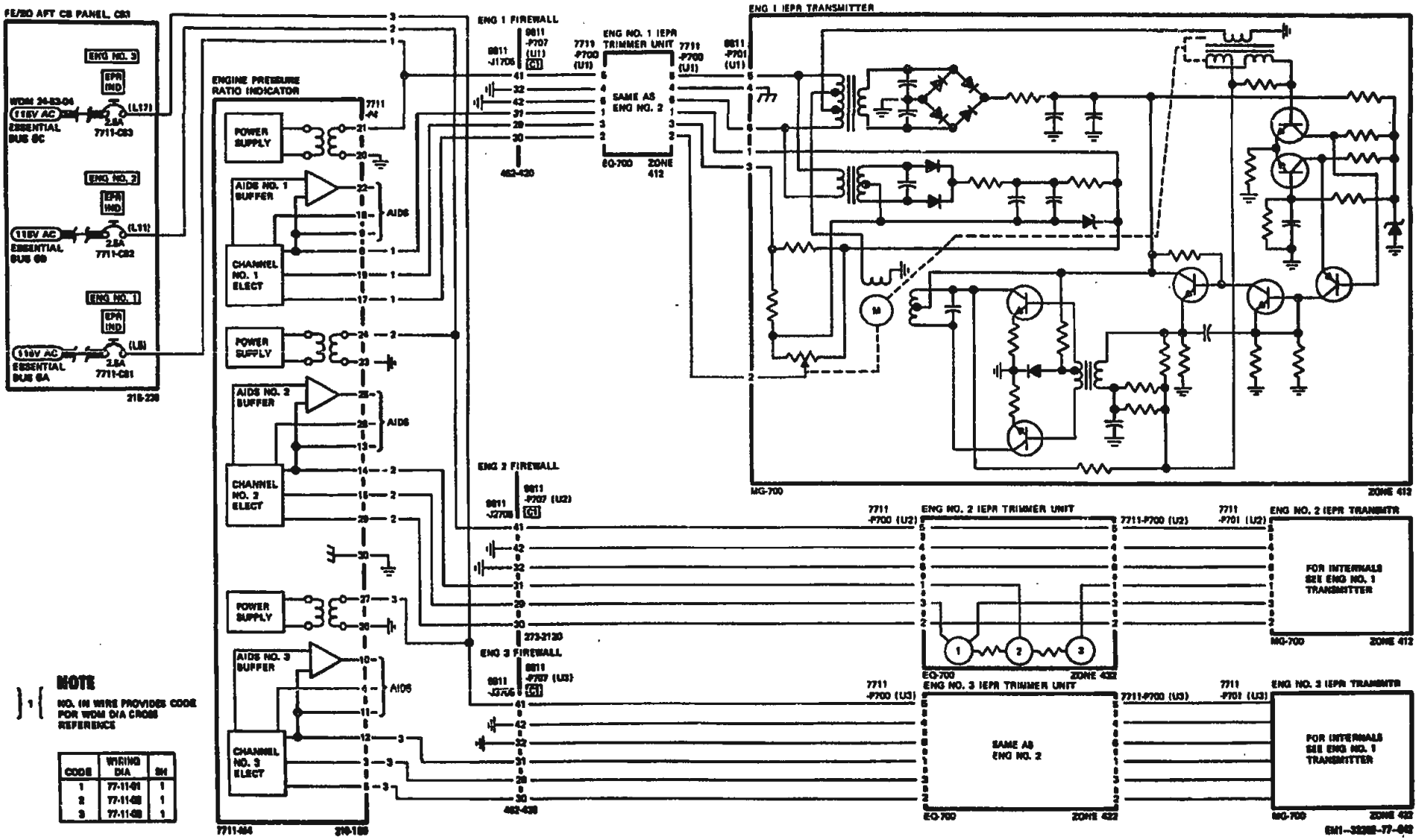
⚠1 **NOTE**
A high EPR reading indicates a PI leak. A low EPR reading indicates a PR or P8 Rake lead

⚠2 Replace trimmer resistors with resistors of same value as indicated by code letter stamped on engine data slip plate

PREREQUISITES
Elec Pwr (24-41-00)
CB's: CB3-L5, L11, or L17

M1-0006-77-131

IEPR Indication System Fault Isolation
Figure 103



IEPR Indicating System Circuits
SCHEM 1

R EFFECTIVITY: ALL
R
001B

C ENGINE PRESSURE RATIO (EPR) - MAINTENANCE PRACTICES

C 1. Engine EPR System Tolerance

C A. Three factors contribute to an apparent and/or low EPR reading(s) which are not in fact low. This low EPR reading results from aligning engine parameters other than EPR. These factors are:

C (1) Production engines, fresh from repair and test, exhibit scatter in all parameters, except EPR, at fixed power settings.

C (2) The electronic portion of the EPR system (indicator and transmitter) is only accurate to ±.007 EPR.

C (3) The ability of the pressure sensing portion of the EPR system (P8 probes, Pf probes, integrator block, etc.) to deliver the correct signal to the transmitter is accurate to ±.003.

C B. When these factors are considered, the following parameter spreads, between engines at the same power (EPR), are possible:

N1	1.6%
TGT	18°C
Fuel Flow	640 pph
N3	1.2%

C C. If an attempt is made to align these parameters, not recognizing that this spread is reasonable, a .026 spread in EPR results.

CR D. When EPR is written up as reading in error by .026 or less, the item may be signed off as within acceptable limits. If the EPR is written up as reading in error by more than .026, it should be considered malfunctioning and corrected or placarded inop per minimum equipment. (Contact the MCI Coordinator since this is a designated MEL item).

CR E. EPR error, if more than .026, may be considered operative provided certain system checks are accomplished and no engine operating limits are exceeded.

CR F. These checks are as follows:

CR NOTE: When positive correction is found and corrected, the balance of these checks can be omitted.

CR High EPR

CR (1) Replace N1 indicator.

CR (2) Replace EPR indicator.

CR (3) Replace EPR transmitter.

CR (4) Leak check P1 system, reference MM 77-11-00.

CR NOTE: Check for correct bolts at FFR P1 tube/fuel flow
CR regulator disconnect.

CR (5) Replace P1 probe.

CR (6) Check EPR calibration all three engines per MM
CR 77-11-00. Send completed sheets to MCIEE, Pinkston,
CR 1-408, MCI.

CR (7) Accomplish Performance Test 6 per M11-71-06. Report
CR findings to MCIEE, Pinkston, 1-408, MCI.

CR Low EPR

CR (1) Replace N1 indicator.

CR (2) Replace EPR indicator.

CR (3) Replace EPR transmitter.

CR (4) Remove/replace integrator block.

CR (5) Remove aids P8 air tube and PF air tube at integrator
CR block and cap. Use P/N 60-4315 cap. Refer to Figure
CR 201.

CR (6) Block PF probe at 12 o'clock position. Refer to Figure
CR 202.

CR (7) Change or leak check PF probe at 3 o'clock and 10
CR o'clock positions.

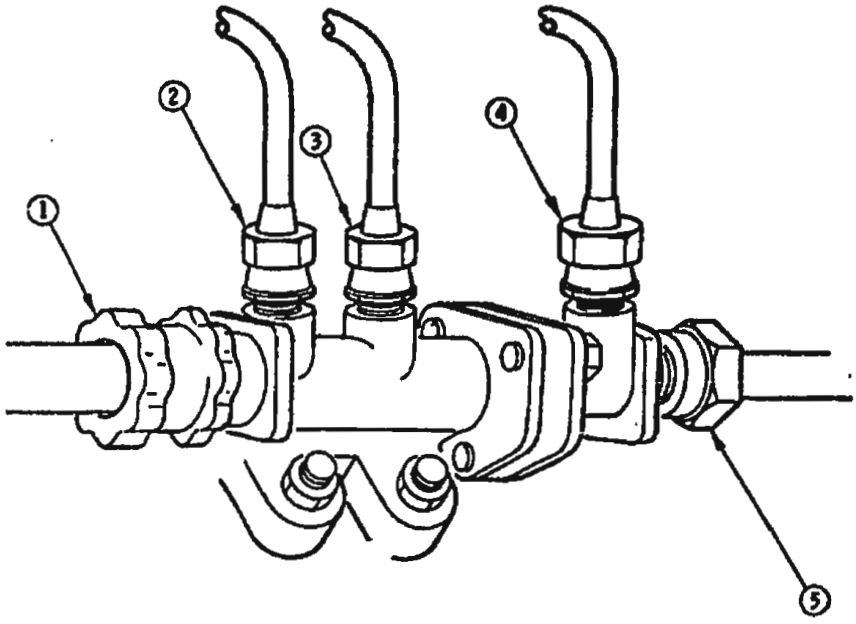
CR (8) Leak check P int lines per MM 77-11-00.

CR (9) Check calibration of all three engines per MM 77-11-00.
CR Send completed sheets to MCIEE, Pinkston, 1-408, MCI.

CR (10) Accomplish Performance Test 6 per M11-71-06. Report
CR findings to MCIEE, Pinkston, 1-408, MCI.

CR G. If, after accomplishment of the foregoing checks, EPR
CR continues to be written up as reading more than .026 in

CR error, engine may be signed off to continue in service as
CR long as no operating limits are exceeded. In the event
CR engine power reduction is necessary to keep any engine
CR parameter from being exceeded, engine will be scheduled for
CR removal.



1. P8 INLET TUBE
2. P8 AIDS TUBE INSTALL CAP P/N 60-4315
3. P INT TUBE
4. PF TUBE AIDS INSTALL CAP P/N 60-4315
5. PF TUBE

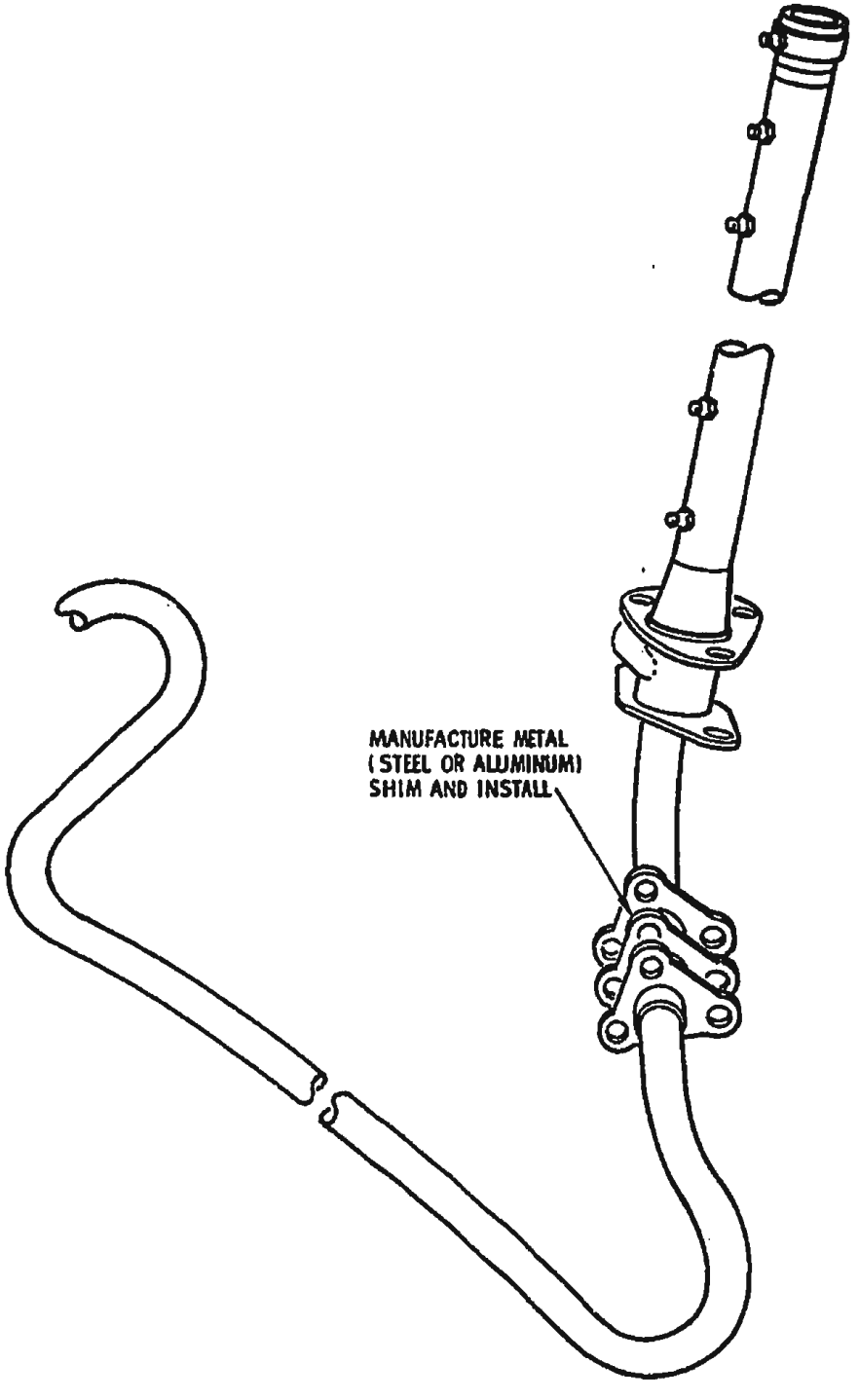
M1-0000-77-318

CR
CR

Multiple Connector (Integrator Block)
Figure 201

R
R
001B

EFFECTIVITY: ALL



M1-0000-77-319

CR P.F. Rake Upper Fan Pressure 12 o'clock psn
CR Figure 202

R EFFECTIVITY: ALL
R
001B

INTEGRATED ENGINE PRESSURE RATIO (IEPR) INDICATING SYSTEM ADJUSTMENT AND TEST

1. Equipment and Materials

C IEPR Test Set, TWA R&R 90087 or equivalent

Test set, Rolls Royce Ltd. PN 1702409 (Smith's No. 3204-KTQ-03 or 3204-KTQ-1)

Power lead, Rolls-Royce Ltd., PN 1702389 (Smith's No. 0101-KCQ-40); use with test set 3204-KTQ-03 or 3204-KTQ-1

R Hoses (2 off), Rolls-Royce Ltd. PN 1702403 (Smith's No. 0101-KHQ-40); use with test set 3204-KTQ-03 or 3204-KTQ-1

P1 Probe cover, Rolls-Royce Ltd., PN UT.885/1, or equivalent

Adapter, Rolls-Royce Ltd., PN UT.909, or equivalent

T-piece and flexible hose assembly, Rolls-Royce Ltd., PN UT.908, or equivalent

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

Splitter Area Access Work Platform, Rolls-Royce Ltd., PN CP20309, or equivalent

2. Referenced Procedures

24-41-00	External Power/Ground Service System - Maintenance Practices
70-51-00	Torque Tightening Technique
71-11-00	Engines No. 1 and No. 3 Cowling - Servicing
71-12-01	LH and RH Lower Hinged Cowl - Servicing
71-12-05	LH and RH Upper Hinged Cowl - Servicing
72-03-00	Gas Generator Fairings - Removal and Installation
78-30-00	Thrust Reverser - Servicing

C 3. IEPR Calibration Test

C A. General - This test to be accomplished as required.

C B. Preparation for Test

C (1) Equipment

C (a) EPR tester, R&R 90087

C (b) AIDS 563 Tester

C (2) Open RH cowl for engines 1 and 3. RH lower cowl for
C engine 2.

C (3) Disconnect P INT line at transmitter, Figure 504.

C (4) Using test hose, connect tester (exhaust) to P INT at
C transmitter.

C (5) Disconnect P_1 line at transmitter, Figure 504.

C (6) Using test hose connect tester (inlet) to P_1 at
C transmitter, Figure 501.

C (7) Install AIDS 563 tester. Refer to M.M. 31-32-

C (8) Assure electrical power to AIDS and EPR system.

C C. EPR Tester R&R 90087 Description (Ref. Fig. 501)

C (1) The tester consists of two sections, one, to the left
C side of the tester, is for decreasing test pressure to
C P? $_2$, and the other, to the right, is for increasing
C test pressure to P? $_1$. Inter-connection between the
C sections, is controlled through one cross-bleed valve.

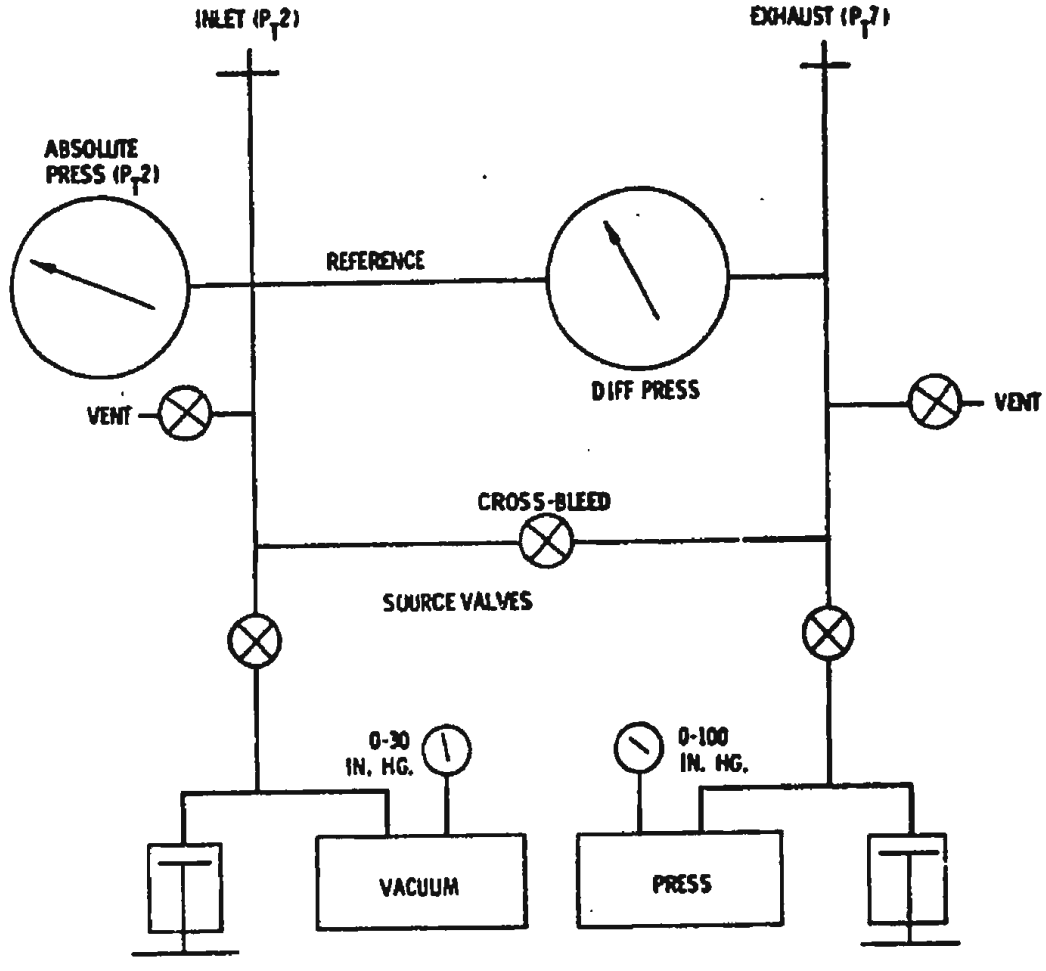
C (2) Each section has a hand pump, supply tank with small
C gage, a source valve, a vent-to-atmosphere valve, a
C large accurate test gage, and a port for connection to
C an aircraft EPR system.

C (3) The gage for P? $_2$, L side, indicates in. hg absolute
C (no reference). The gage for P? $_1$, R side, indicates
C in. hg. differential (reference for this gage is always
C the pressure indicated by the absolute gage). Absolute
C pressure (P? $_2$) plus Diff pressure (P? $_1$) equal P? $_1$
C absolute.

C D. IEPR CALIBRATION TEST PROCEDURE

C (1) Prepare for test per Step 3B.

C (2) Record date, stn, A/C nbr, tester S/N, applic corr'd
C Abs and Diff pressures and test IEPR from tester corr
C card.



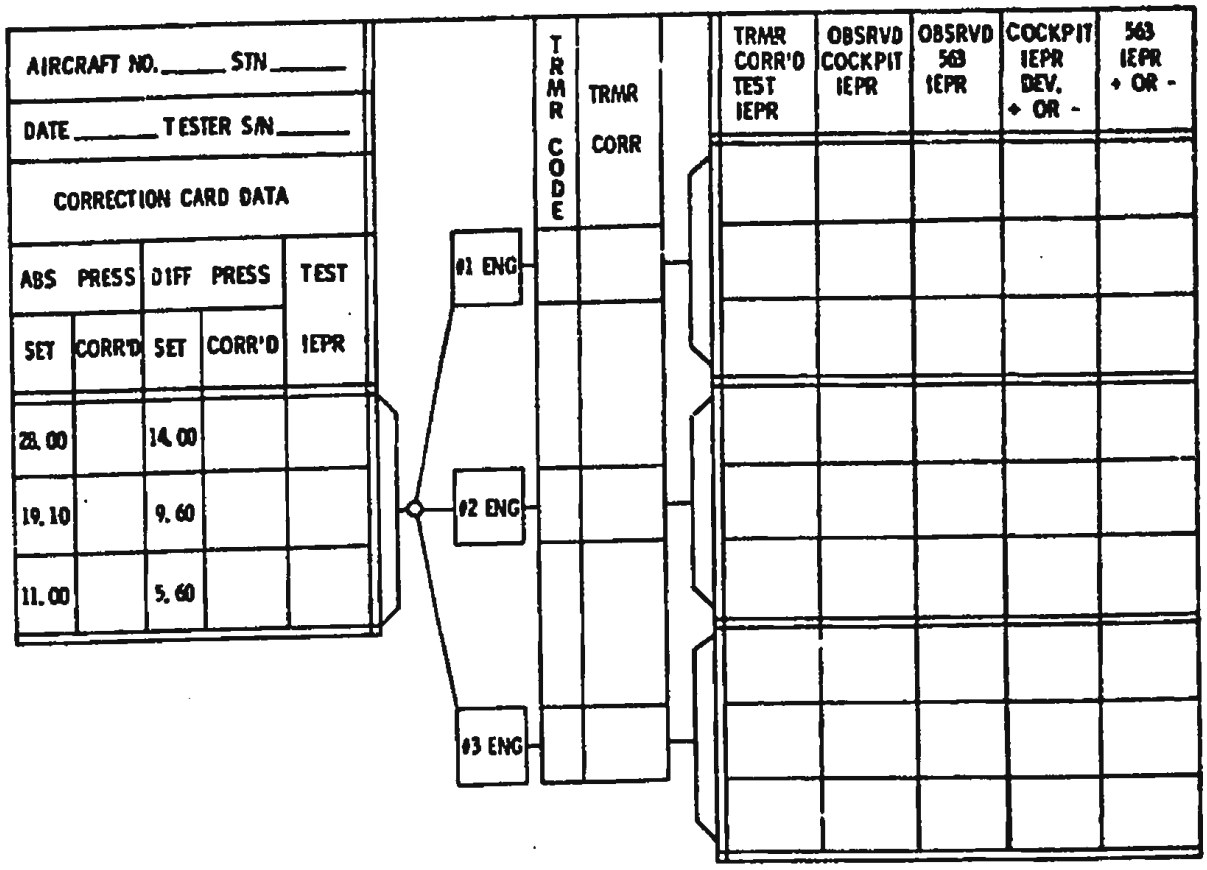
M1-0000-77-293

CR
CR

R&R 90087 EPR TESTER SCHEMATIC
Figure 501

EFFECTIVITY: ALL

001B



EPR TRIMMER CORR

A = .000	E = .008
B = .002	F = .010
C = .004	G = .012
D = .006	H = .014
	J = .016

563 ADDRESSES

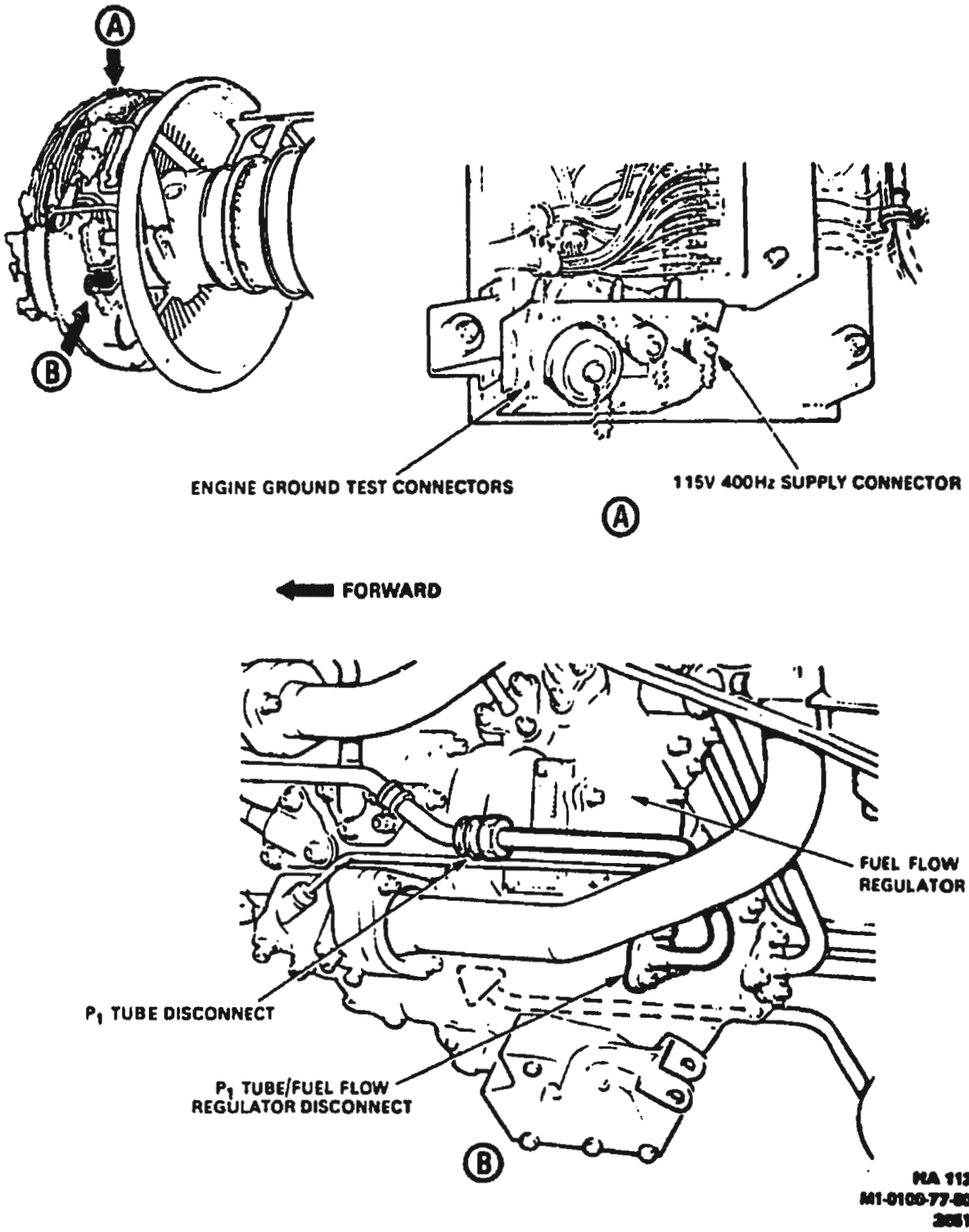
1	IEPR	054
2	IEPR	120
3	IEPR	191

IEPR DEV LIMIT

COCKPIT IND. ± .007
563 TESTER IND ± .007

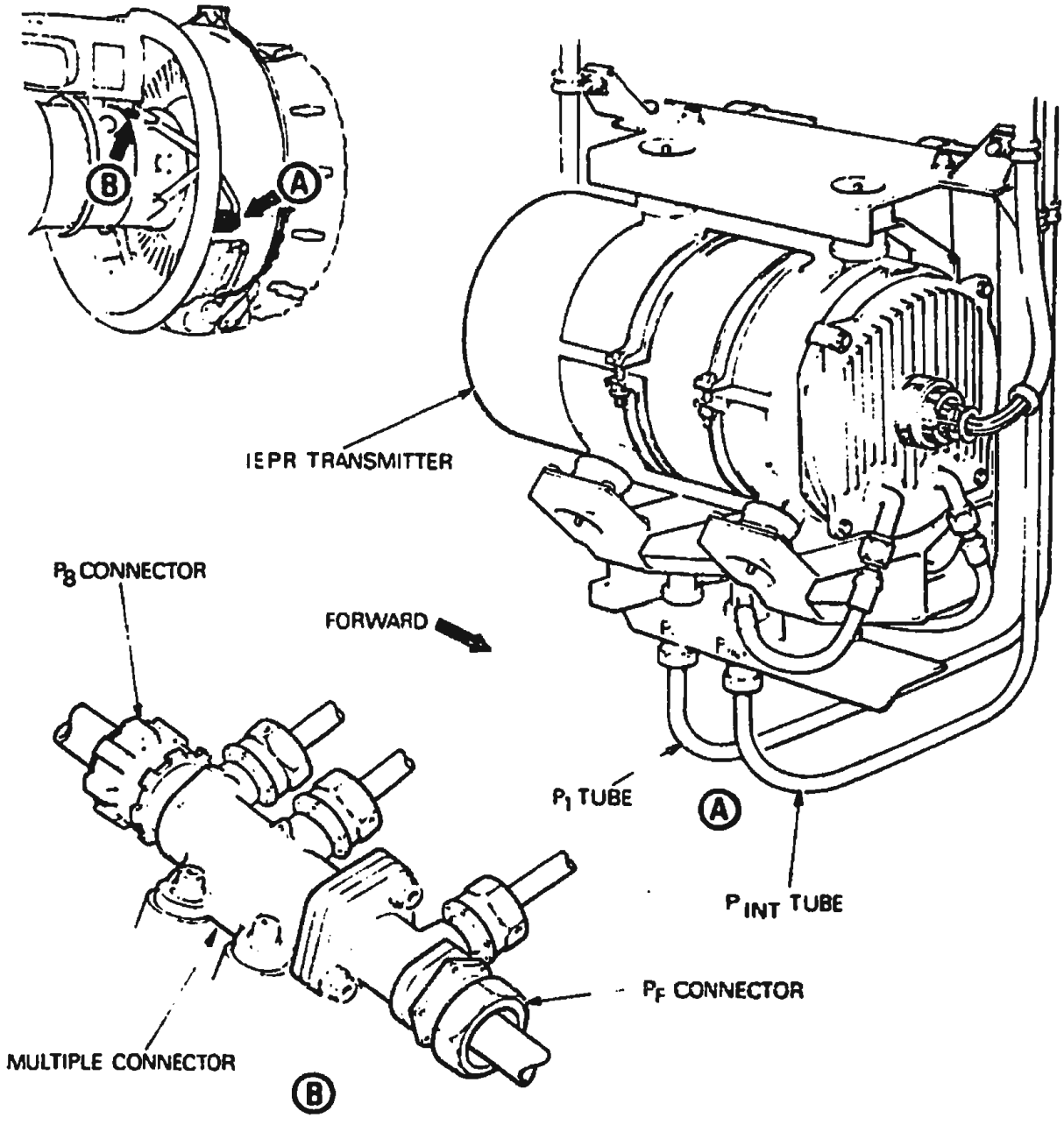
M1-0000-77-234

IEPR Calibration Test
Figure 502



C C IEPR Indicating System Test Points
Figure 503

R R 001B EFFECTIVITY: ALL



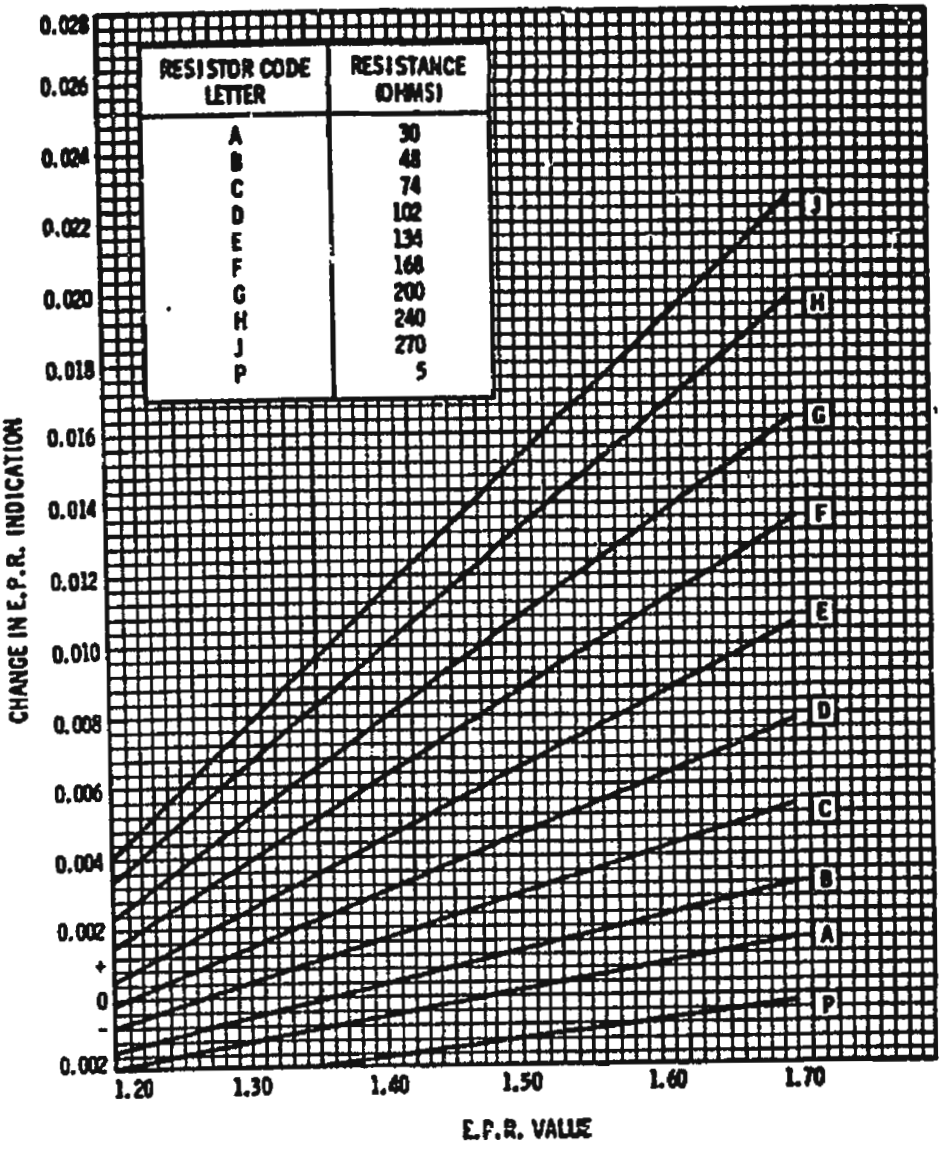
HA 1130
M1-0101-77-608
25791A

C
C

IEPR Transmitter Test Point
Figure 504

R
R
001B

EFFECTIVITY: ALL



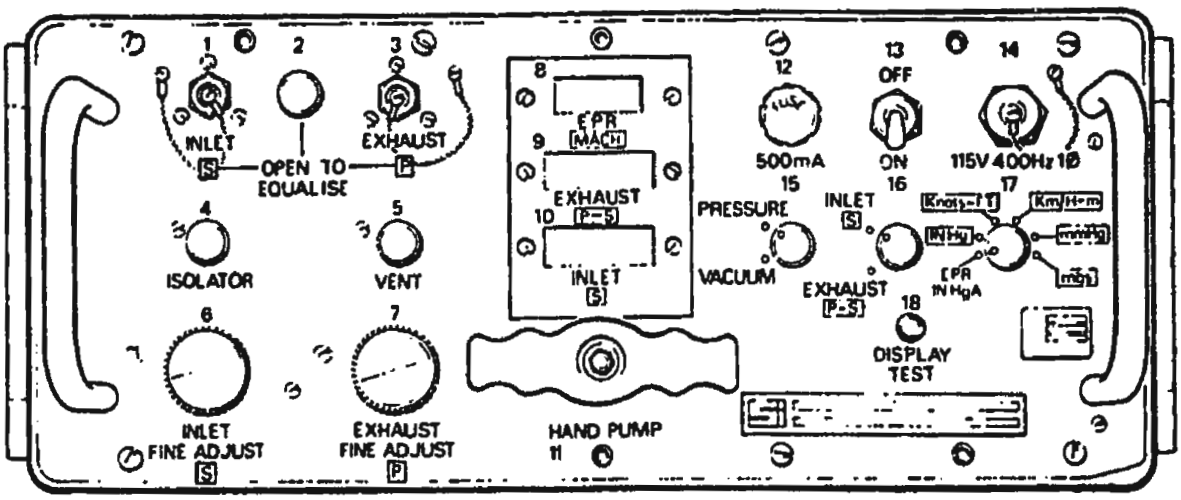
M1-0001-77-512

R
R

EPR Trim Resistor Effect
Figure 505

EFFECTIVITY: ALL

0018



TEST SET 1702409 (SMITHS 3204-KTQ-03 OR 3204-KTQ-1)

56259
M1-0001-77-469

R Test Set Front Panel
R Figure 506

C (3) From eng data plate record trimmer code. From lwr LH corner of Figure 502 record corr for trimmer code.

C (4) Add trimmer corr to test IEPR and record under TRMR CORR'D IEPR.

C (5) Open tester cross-bleed and L. source. (R if SET Abs press above Pamb) and pump to desired SET Abs press. Tapping gage.

C (6) Close cross-bleed and L source. Open R. source. Pump to desired SET Diff press, tapping gage. NEVER EXCEED 1.8 IEPR on cockpit ind.

C (7) With both Abs and Diff gages exactly on target, tap IEPR cockpit ind and record.

C (8) With 563 tester set up on applic address (lwr center of Figure 502) record 563 EPR.

C (9) Compute deviations between:

Cockpit IEPR and TRMR CORR'D TEST IEPR 563 IEPR and TRMR CORR'D TEST IEPR.

C NOTE: When TEST IEPR is least Dev is plus.

C (10) Record Dev's. Ind plus or minus.

C (11) Repeat items (3) thru (10) for remaining 2 TEST IEPRS.

C (12) Return tester to Pamb by 1st opening cross-bleed and then RH vent.

C (13) Repeat all of the foregoing on other engines as required.

C (14) Remove all equipment and restore A/C to airworthy configuration.

C 4. IEPR Leak Tests

C A. General - These tests to be accomplished as required.

C WARNING: VERIFY THAT THRUST REVERSER SYSTEM IS LOCKED IN FORWARD THRUST POSITION (REF. 78-30-00, SERVICING) WHILE WORK IS IN PROGRESS.

C B. Preparation for P INT Leak Test

C (1) On pilots overhead circuit breaker panel CB1, zone 210, open and tag applicable engine circuit breakers thrust reverse (H16, H17, or H18) and start valve (E13, E14, or E15).

C (2) On pilots center console, zone 210, place warning tags on applicable power control levers, thrust reverser levers, and on APU/GROUND air to reverser toggle switches.

C (3) Install thrust reverser mechanical locks (Ref. 78-30-00) and install isolation valve lockout pin as follows:

C (a) Gain access to applicable engine isolation valve by opening panel 511 LB-3 for engine No. 1, 611 LB-3 for engine No. 3, or 471AL for engine No. 2.

C (b) Verify that isolation valve is in closed position (external arm in position C).

C (c) Remove threaded lockout pin from stowed position, install it through hole in external arm screwing it securely into valve body, and tag with REMOVE BEFORE FLIGHT streamer.

C (4) Position splitter area access work platform in cold stream exhaust collector nozzle, zone 435.

C (5) Open applicable LH hinged cowl 413A or 423A for engines No. 1 or 3 (Ref. 71-11-00) or LH upper hinged cowl 433DL for engine No. 2 (Ref. 71-12-05).

C (6) Remove compressor section RH upper and rear gas generator fairings (Ref. 72-03-00).

C (7) Disconnect P8 connector (Ref. Fig. 504) at multiple connector and install adapter.

C (8) Disconnect PF connector at multiple connector and install cover.

C NOTE: To enable the PF tube to be disconnected, it may be necessary to release the bolts securing the multiple connector to the intermediate case.

C (9) Connect hose to adapter previously attached to multiple connector.

C (10) Connect other end of hose (Ref. Fig. 501) to test set pressure connector.

C. P INT Leak Test Procedure

(1) Pump up pressure source.

(2) Close vent valve, open shut-off valve and set pressure gage to 14 in HG differential.

CAUTION: DO NOT INCREASE PRESSURE TO GIVE AN ENGINE PRESSURE RATIO GREATER THAN 1.8 AT EPR INDICATOR.

(3) Pressure must be maintained for minimum of 1 minute.

(4) Open shut-off valve and vent valve to release pressure.

(5) Disconnect hose (Ref. Fig. 504) from adapter attached to multiple connector.

(6) Remove cover from PF connector (Ref. Fig. 504) and install connector (Ref. 70-51-00) and lock-wire.

(7) Remove adapter from P8 connector and install P8 tube to multiple connector. Tighten P8 tube connector (Ref. 70-51-00) and lock-wire. If released, tighten bolts to secure multiple connector to intermediate case.

(8) Install compressor section RH upper and rear gas generator fairings (Ref. 72-03-00).

(9) Remove working platform from cold stream nozzle.

(10) Remove thrust reverser mechanical lock (Ref. 78-30-00) and isolation valve lockout pin installed in Step B(2).

(11) Close cowl opened in Step B(5).

(12) Remove WARNING tags installed in Step B(2).

(13) Remove tags and close circuit breakers opened in Step B(1).

D. Preparation for P1 Tube Leak Test

(1) Open applicable LH hinged cowl 413A or 423A for engines No. 1 or 3 (Ref. 71-11-00) or LH upper hinged cowl 433DL for engine No. 2 (Ref. 71-12-05).

Open applicable hinged cowl 413A or 423A and 414A or 424A for engine No. 1 or 3 (Ref. 71-11-00) or upper hinged cowl 433 DL and 434DR (Ref. 71-12-05) and lower hinged cowl 433AL and 434AR (Ref. 71-12-01) for engine No. 2.

C (2) Disconnect P1 air tube (Ref. Fig. 503)at fuel flow
C regulator and tube disconnect, and remove air and cap
C line.

C (3) Install plug in P1 probe.

C (4) Disconnect P1 tube (Ref. Fig. 504) at IEPR transmitter
C and attach test hose to P1 tube.

C (5) Connect test hose to test set pressure connector (Ref.
C Fig. 501).

C E. P1 Tube Leak Test Procedure

C (1) Close vent valve, open shut-off valve and set pressure
C gage (absolute) to 36 in HG.

C (2) Pressure must be maintained for minimum of 1 minute.

C (3) Open shut-off and vent valve to release pressure.

C (4) Disconnect test hose at test set pressure connector and
C installed duct cap.

C (5) Disconnect Disconnect opposite end of hose at P1 tube.

C (6) Connect P1 tube to transmitter, then tighten tube
C connector (Ref. 70-51-00) and lock-wire.

C (7) Connect and secure P1 air tube at fuel flow regulator.
C Torque tighten (Ref. 70-51-00) and lock-wire.

C (8) Remove cover from P1 probe.

C (9) Close cowl opened in Step 1.

4. Functional Test Using Smith's Test Set 3204-KTQ-03 or 3204-KTQ-1

A. Preparation for Test

(1) Open left hinged cowl 413A or 423A for engines No. 1 or 3 (Ref. 71-11-00) or left upper hinged cowl 433DL for engine No. 2 (Ref. 71-12-05). Open right hinged cowl 414A or 424A for engines No. 1 or 3 (Ref. 71-11-00) or right lower hinged cowl 434AR for engine No. 2 (Ref. 71-12-01).

(2) Connect lead 0101-KCQ to 115V 400Hz supply connector, and test set input connector (14) (Ref. Fig. 503).

(3) Verify that valves (2), (4) and (5) are turned clockwise to fully closed position (Ref. Fig. 506).

(4) Turn on electrical power (Ref. 24-41-00).

(5) On FE/SO aft CB3 panel, zone 215, verify that following circuit breakers are closed:

EPR IND (L5), (L11), (L17)

CTR INSTR & GLARE SHLD (J13)

FLT RECORDER DC (G4)

FLT RECORDER AC (G5)

(6) Position test set power switch (13) to ON and allow 2 minutes for test set to stabilize.

(7) Depress DISPLAY TEST switch (18).

NOTE: Test sequence will continue only while switch is depressed.

Pressure and EPR/MACH displays (8), (9), and (10) will initially read all 8's, and then run through complete digit sequence, all 0's to all 9's.

(8) Remove covers from INLET connector (1) and EXHAUST connector (3).

(9) Open VENT valve (5) and position selector (16) to INLET. Displays (9) and (10) must read ambient baraometric pressure and display (8) must read 1.000.

(10) Close VENT valve (5).

(11) Connect hoses to E.P.R. transmitter and test set as follows:

(a) Disconnect P1 tube from E.P.R. transmitter and connect hose to P1 connector on transmitter (Ref. Fig. 504).

(b) Disconnect P INT tube from E.P.R. transmitter and connect second hose to P INT connector on transmitter.

(c) Connect hose from P1 connector on E.P.R. transmitter to test set INLET connector (1), and

hose from P INT connector on E.P.R. transmitter to test set EXHAUST connector (3) (Ref. Fig. 506).

B. Test E.P.R. Transmitter and Indicator

(1) Test E.P.R. calibration at ambient barometric pressure as follows:

(a) Obtain and record ambient barometric pressure from test set [Ref. Step 4A(9)].

(b) Calculate P INT (Ambient barometric pressure x E.P.R. value) at each of the following E.P.R. values:

1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7 and 1.8

(c) Position selector (17) to E.P.R. (Ref. Fig. 506).

(d) Position selector (15) to PRESSURE.

(e) Position selector (16) to EXHAUST.

(f) Verify that OPEN TO EQUALISE valve (2) is fully closed.

(g) Close VENT valve (5).

(h) Open ISOLATOR valve (4).

CAUTION: DO NOT INCREASE P INT PRESSURE TO GIVE AN ENGINE PRESSURE RATIO GREATER THAN 1.8 AT E.P.R. INDICATOR.

(i) Using HAND PUMP (11), increase pressure to achieve in sequence on display (9), the P INT values as calculated in Step 4B(1)(b). Use EXHAUST FINE ADJUST control (7), as necessary, to achieve exact P INT values. At each P INT value, record test set E.P.R. from display (8), and E.P.R. from indicator of system on test.

(j) Refer to engine data slip plate and record trimmer resistor code letter against I.E.P.R. TRIMMER CODE.

(k) Using graph and test set E.P.R. recorded in Step 4B(1)(i), read change in E.P.R. indication for applicable trim code letter recorded in Step 4B(1)(j) (Ref. Fig. 505).

R (l) Apply change in E.P.R. indication recorded in Step
R 4B(1)(k), to E.P.R. readings taken from indicator
R of system on test recorded in Step 4B(1)(i).

R (m) Compare E.P.R. readings taken from test set in
R Step 4B(1)(i) with calculated E.P.R. values
R recorded in Step 4B(1)(l). These must be within
R plus or minus 0.007 of each other.

R (n) Open VENT valve (5)(Ref. Fig. 506).

R (2) Test altitude E.P.R. calibration

R (a) Position selector (15) to VACUUM (Ref. Fig. 506).

R (b) Position selector (16) to INLET.

R (c) Open OPEN TO EQUALISE valve (2).

R (d) Close VENT valve (5).

R (e) Using HAND PUMP (11), increase pressure to achieve
R a reading of 10.00 in. Hg. on displays (9) and
R (10).

R (f) Close ISOLATOR valve (4).

R (g) Close OPEN TO EQUALISE valve (2).

R (h) Position selector (16) to EXHAUST.

R (i) Position selector (15) to PRESSURE.

R (j) Open ISOLATOR valve (4). Verify that reading on
R display (9) shows an increase. Close ISOLATOR
R valve (4) when E.P.R. on display (8) reads 1.1.
R Record E.P.R. from indicator of system on test.

R (k) Repeat Step 4B(2)(j) for each following E.P.R.
R value:

R 1.2, 1.3, 1.4, 1.5, 1.6, 1.7 and 1.8

R NOTE: To achieve exact E.P.R. readings, it may be
R necessary to use HAND PUMP (11) or EXHAUST
R FINE ADJUST valve (7).

R (l) Using graph and test set E.P.R. used in Steps
R 4B(2)(j) and 4B(2)(k), read change in E.P.R.
R indication for applicable code letter (Ref. Fig.
R 505).

(m) Apply change in E.P.R. indication recorded from graph, (Ref. Fig. 505), to E.P.R. readings taken from indicator of system on test.

(n) Compare test set E.P.R. used in Steps 4B(2)(j) and 4B(2)(k) with calculated E.P.R. valves recorded in Step 4B(2)(m). These E.P.R. values must be within 0.011 of each other.

(3) Open OPEN TO EQUALISE valve (2) (Ref. Fig. 506).

(4) Open VENT valve (5).

(5) Position test set power supply switch (13) to OFF.

(6) Turn off electrical power (Ref. 24-41-00).

(7) Disconnect and remove 115V 400Hz power input lead from supply connector and test set input connector (14) (Ref. Fig. 503 and 506).

(8) Remove hoses from E.P.R. transmitter and test set as follows:

(a) Disconnect and remove hoses from P1 and P INT connectors on E.P.R. transmitter (Ref. Fig. 504).

R R (b) Connect and secure P1 and P INT tubes E.P.R. transmitter. Torque tighten (Ref. 70-51-00) and lock-wire.

(c) Disconnect and remove hoses from test set, install covers on INLET connector (1) and EXHAUST connector (2).

(9) Close left and right hinged cowls opened in Step 4A(1).

INTEGRATED ENGINE PRESSURE RATIO TRANSMITTER REMOVAL AND INSTALLATION

1. Equipment and Materials

Protective caps

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter, or equivalent

2. Referenced Procedures

70-51-00	Torque Tightening Technique
71-11-00	Engines No. 1 and No. 3 Cowling - Servicing
71-12-01	LH and RH Lower Hinged Cowl - Servicing
77-11-00	Integrated Engine Pressure Ratio Indicating System - Adjustment and Test

R Service Bulletins Referred To:

R RR SB36-2441 - Thrust Reverser Deactivating Valve

R RR SB71-2577 - Additional Clipping

3. Removal/Installation

A. Removal

(1) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag applicable EPR IND (L5, L11, or L17) circuit breaker.

(2) Open RH hinged cowl 414A or 424A for engine No. 1 or 3 (Ref. 71-11-00), or lower RH hinged cowl 434AR for engine No. 2 (Ref. 71-12-01).

R CAUTION: ENSURE ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE DISCONNECTING.

(3) Disconnect electrical connector at forward end of transmitter (Ref. Fig. 401).

(4) Remove bracket securing nuts and bolts.

R NOTE: On engines with RR SB36-2441,
R bolts are removed downwards.

NOTE: On engines with RR SB71-2577, remove nuts and bolts to release bracket on lower section of cradle assembly.

(5) Disconnect P1 inlet and P INT inlet connectors from transmitter connections at bottom of mounting base.

(6) Support unit and remove securing bolts and washers then remove transmitter assembly.

(7) Install protective caps on electrical connectors and pressure connectors.

B. Installation

(1) Verify that circuit breaker opened in Step 3A(1) is open and tagged.

(2) Remove protective caps from electrical connector and pressure openings.

(3) Position transmitter assembly on LP compressor case and secure with bolts and washers.

R (4) Connect P1 and P INT tubes at bottom of mounting base and torque tighten (Ref. 70-51-00) and lock-wire.

On engines with RR SB71-2577, position harness bracket on lower section of cradle assembly and secure with nuts and bolts.

(5) Position bracket and secure with nuts and bolts.

NOTE: On engines with RR SB36-2441, ensure the two additional brackets are positioned correctly and that the securing bolts are entered from below.

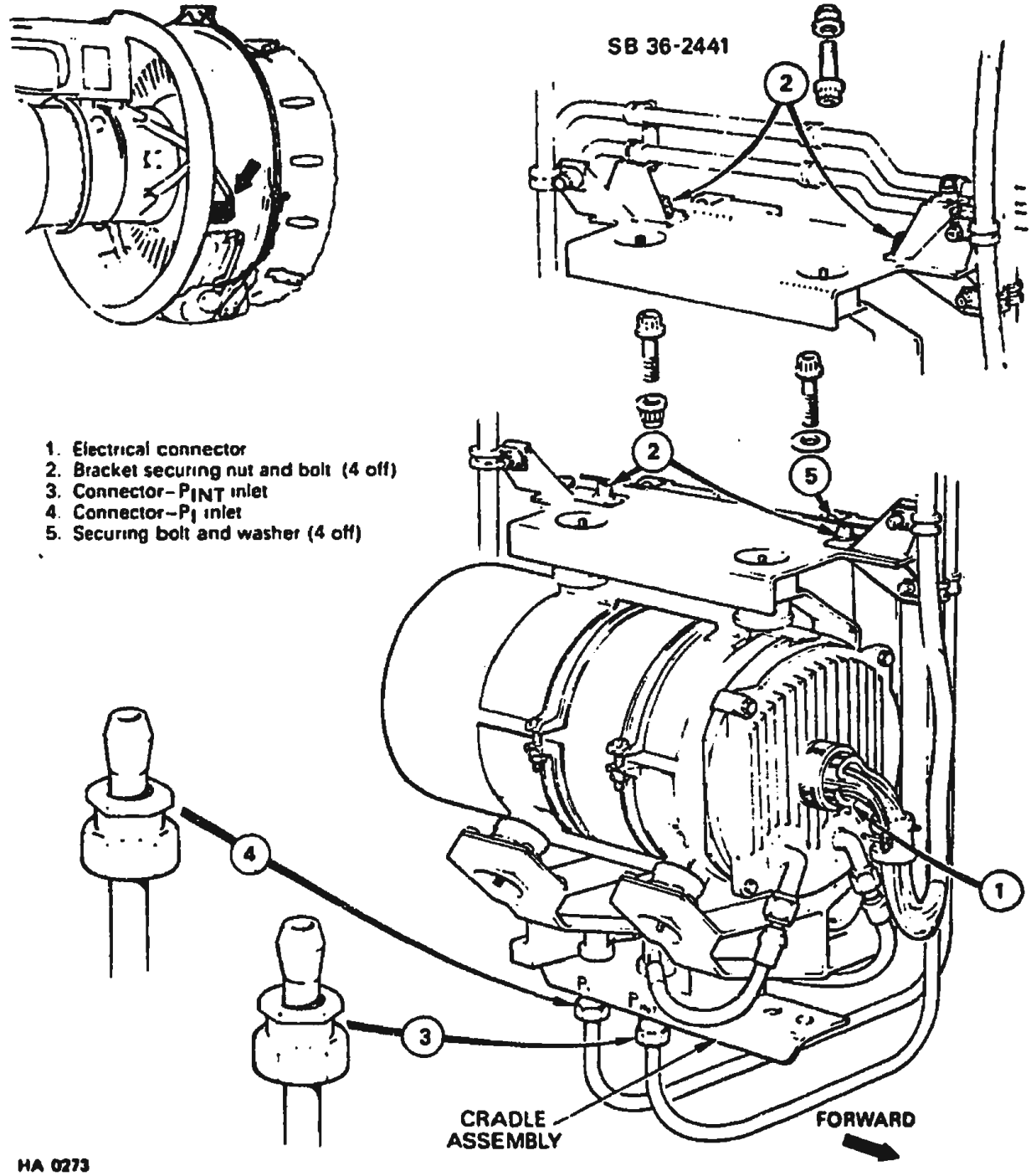
CAUTION: ENSURE ELECTRICAL CONNECTOR IS FREE OF LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(6) Connect and secure electrical connector to connector on transmitter.

(7) Remove tag and close circuit breaker opened in Step 3A(1).

(8) Close cowl (Ref. 71-11-00 or 71-12-01).

C (9) Perform an operational test at time of next engine run.



Integrated Engine Pressure Ratio Transmitter
Removal and Installation
Figure 401

EFFECTIVITY: ALL

001B

ENGINE PRESSURE RATIO INDICATOR - REMOVAL AND INSTALLATION

1. Removal/Installation

A. Removal

(1) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag the applicable EPR IND circuit breaker.

On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breaker CTR INSTR & GLARE SHIELD

(2) Locate the engine pressure ratio (EPR) indicator on the pilots center instrument panel, zone 210, (Ref. Fig. 401).

(3) Loosen triwing fasteners and withdraw indicator to gain access to electrical connectors.

(4) Disconnect electrical receptacle connector from indicator. Tape and stow connector.

B. Installation

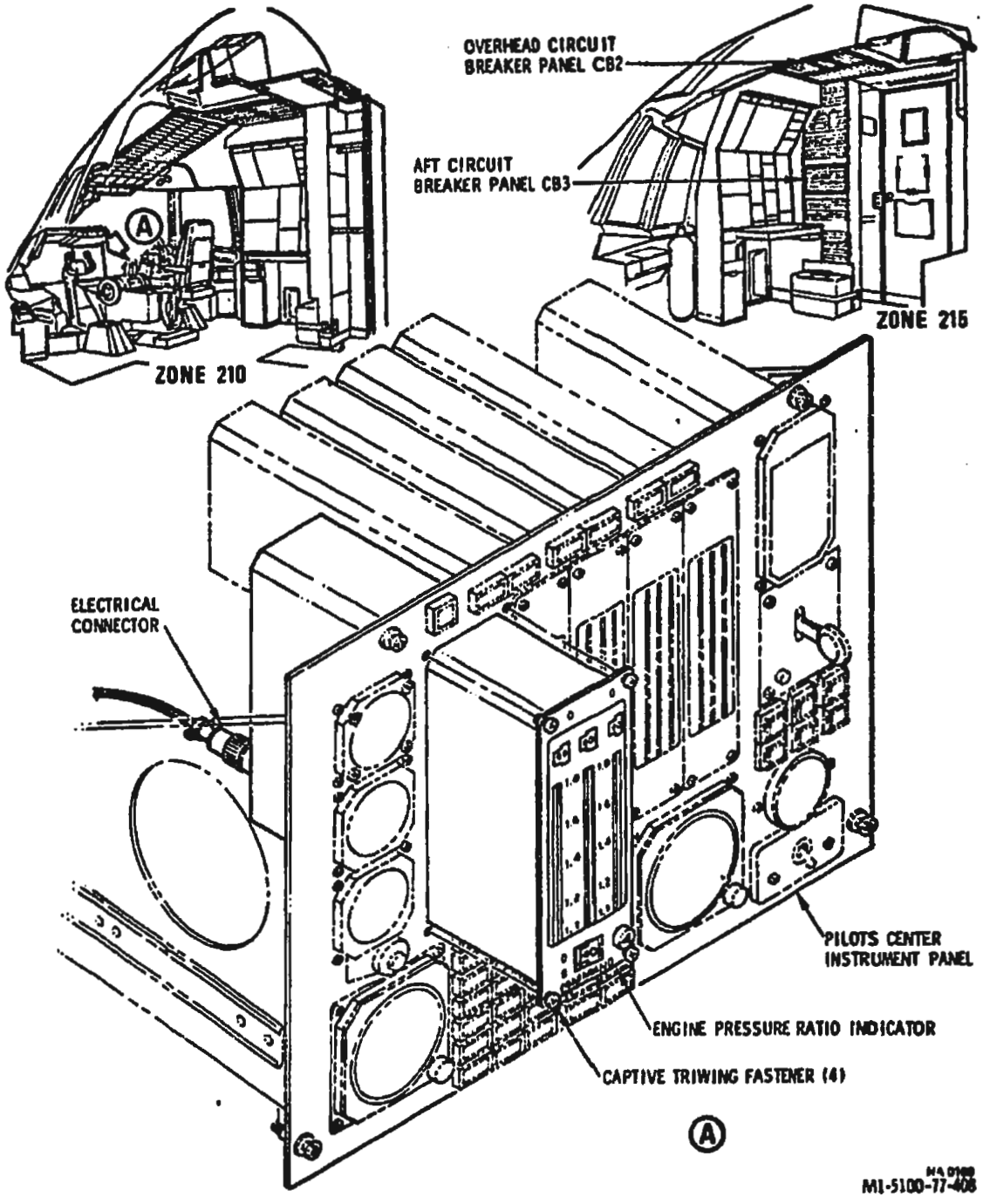
(1) Verify that circuit breakers opened in Step A(1) are open and tagged.

(2) Mate electrical connector on indicator to harness connector.

(3) Slide indicator into panel cutout until flange contacts panel. Secure indicator by tightening triwing fasteners.

(4) Remove tags and close circuit breakers opened in Step A(1).

CR (5) Perform an operational test at time of next engine run.



Engine Pressure Ratio Indicator - Removal and Installation
Figure 401

R PF RAKE MULTIPLE CONNECTOR AND TUBES - REMOVAL AND INSTALLATION

1. Equipment and Materials

Working Platform, Rolls Royce Ltd., P/N CP.20309 or XUT.37594 or spacer, P/N XUT.42526 and Side Piece, P/N XUT.42527, or equivalent.

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter; British Spec DTD. 189A 225WG, OMat Item No. 238; or equivalent.

2. Referenced Procedures

70-51-00	Torque Tightening Technique
72-03-00	Gas Generator Fairing - Removal and Installation
78-30-00	Thrust Reverser - Servicing

3. Removal/Installation

A. Removal

WARNING: VERIFY THAT THRUST REVERSER SYSTEM IS LOCKED IN FORWARD THRUST POSITION WHILE WORK IS IN PROGRESS.

(1) Deactivate and tag thrust reverser and associated systems, and install thrust reverser mechanical locks (Ref. 78-30-00).

(2) Install working platform in cold stream duct.

(3) Remove applicable access panels as follows (Ref. 72-03-00):

(a) Combustion Section RH Fairing 412JR, 422JR, or 432JR.

(b) Compressor Section Rear RH Fairing 412FR, 422FR, or 432FR.

(c) Compressor Section Front RH Fairing 412BR, 422BR, or 432BR.

(d) Compressor Section Upper RH Fairing 412AR, 422AR, or 432AR.

(4) Disconnect air tube connectors (1), (2), (3), (4), and (5) (Ref. Fig. 401).

(5) Remove bolts (6) then remove multiple connector (7).

(6) Install approved caps to air tubes and multiple connector.

NOTE: On engines without RR SB71-3124,
R a harness support bracket is fitted under the
R uppermost bolts securing the multiple connector.

NOTE: On engines with RR SB72-3310 and without RR SB72-3732,
R a harness support bracket is fitted under the
R two lower bolts securing the multiple connector.

B. Installation

(1) Verify that thrust reverser and associated systems are deactivated and locked (Ref. 78-30-00).

(2) Verify that working platform is installed in cold stream duct.

(3) Remove caps from air tubes and multiple connector.

(4) Position multiple connector (7) on intermediate case then install and secure bolts (6) (Ref. Fig. 401).

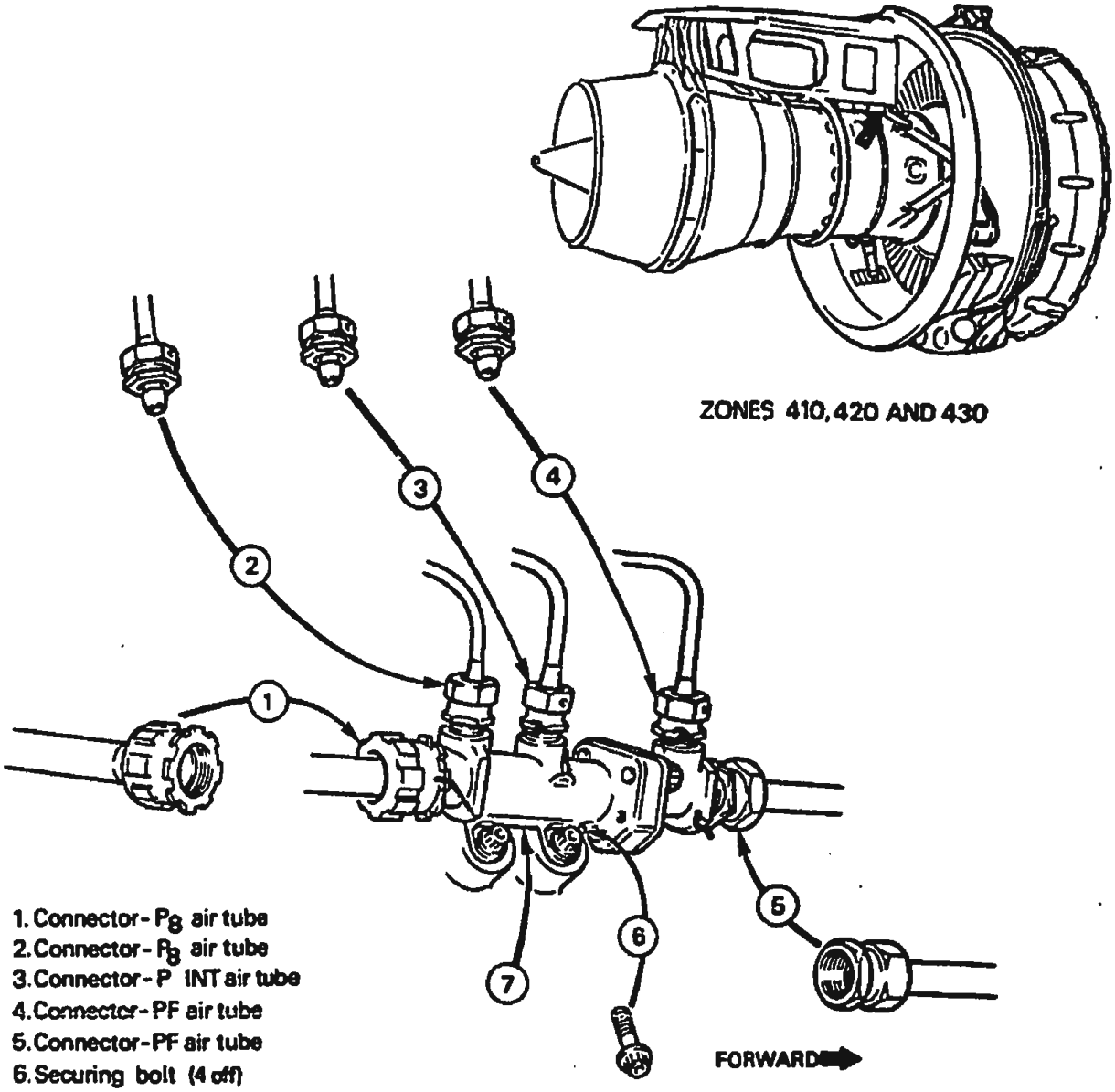
NOTE: On engines without RR SB71-3124,
R locate harness support bracket under two
R uppermost bolts.

(5) Install and secure air tube connectors (5), (4), (3), (2), and (1), and lock-wire (Ref. 70-51-00).

(6) Install access panels removed in step 3A(3).

(7) Remove working platform from cold stream duct.

(8) Unlock and reactivate thrust reverser and associated systems (Ref. 78-30-00).


ZONES 410, 420 AND 430
1. Connector - P_8 air tube
2. Connector - P_8 air tube
3. Connector - P INT air tube
4. Connector - PF air tube
5. Connector - PF air tube
6. Securing bolt (4 off)
7. Multiple connector
FORWARD

32514
M1-0100-77-111

Multiple Connector
Figure 401

EFFECTIVITY: ALL

001B

PF RAKE MULTIPLE CONNECTOR AND TUBES - CLEANING AND PAINTING

1. Equipment and Materials

Clean stiff bristled brush

	British Spec./Ref.	American Spec./Ref.	OMat Item No.
White spirit	B.S.245		102
or			
Stoddard Solvent		ASTM D.484-52	1/5
Jointing compound	DTD.900/4586 (Hylomar light)		426A
Degreasing fluid (Inhibted and stabilized 1.1.1 trichloroethane)	B.S.4487: 1969		

2. Referenced Procedures

77-11-04 PF Rake Multiple Connector - Removal and Installation

3. Cleaning

(1) Remove multiple connector (Ref. 77-11-04).

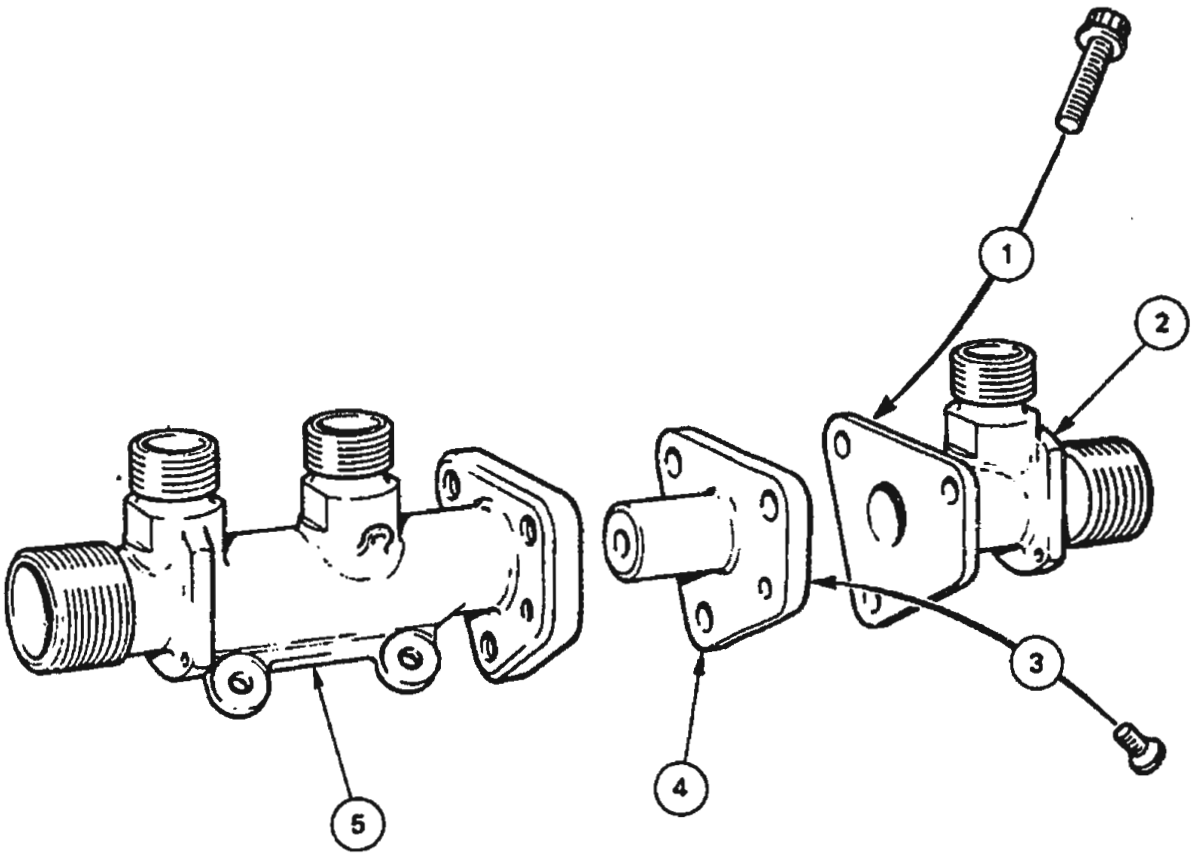
R CAUTION: SHOULD ANY PART DISTURBED DURING THE FOLLOWING OPERATIONS BE UNSERVICEABLE, THE COMPLETE UNIT MUST BE CHANGED.

(2) Remove bolts (1), then remove three-way adapter (2) (Ref. Fig. 701).

(3) Remove screw (3), then remove flanged metering plug (4) from multiple connector (5).

(4) Wash the parts of the multiple connector in white spirit or Stoddard Solvent.

(5) Dry parts in clean, dry air blast.



1 Securing bolt (3off)
2 Three-way adapter
3 Securing screw
4 Flanged metering plug
5 Multiple connector

37076
M1-0101-77-141

R R Multiple Connector Disassembly
Figure 701

R R EFFECTIVITY: ALL

001B

R WARNING: WHEN USING DEGREASING FLUID, AVOID SKIN CONTACT AND INHALING THE VAPOR.

(6) Using degreasing fluid, clean mating faces of three-way adapter (2), flanged metering plug (4) and multiple connector (5): allow to dry.

(7) Using brush, apply thin film of jointing compound to mating faces of three-way adapter (2), flanged metering plug (4) and multiple connector (5); allow to air dry for at least 10 minutes.

(8) Fit flanged metering plug (4) to multiple connector (5); fit and tighten screw (3).

(9) Fit three-way adapter (2) to flanged metering plug and secure with bolts (1).

(10) Using suitable equipment to supply clean, dry air, fit feed line to one connector on multiple connector and fit blanks to the remaining connectors.

(11) Pressurize multiple connector to 25 psig and check for leaks. No leaks are acceptable.

(12) Install multiple connector (Ref. 77-11-04).

C

P8 PROBE - REMOVAL AND INSTALLATION

C 1. Equipment and Materials

C Working Platform, Rolls Royce Ltd., P/N CP.20309 or XUT.37594 or
C spacer, P/N XUT.42526 and Side Piece, P/N XUT.42527, or
C equivalent.

C Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter; British Spec
CR DTD. 189A 22SWG, OMat Item No. 238; or equivalent.

C 2. Referenced Procedures

C 70-51-00 Torque Tightening Technique

C 72-03-00 Gas Generator Fairing - Removal and Installation

C 3. Removal/Installation

C A. Removal

C WARNING: VERIFY THAT THRUST REVERSER SYSTEM IS LOCKED IN
C FORWARD THRUST POSITION WHILE WORK IS IN PROGRESS.

CR (1) Deactivate and tag thrust reverser and associated
C systems, and install thrust reverser mechanical locks
C (Ref. 78-30-00).

CR (2) Remove applicable access panels as follows (Ref.
C 72-03-00).

C (a) Combustion Section Fairing 417A, 427A, or 437A.

CR (b) Combustion Section Fairing 416 BL and BR, 426 BL
CR and BR, or 436 BL and BR.

CR (c) Combustion Section Fairing 418 DL and DR, 428 DL
CR and DR, or 438 DL and DR.

CR (3) Disconnect air tube connectors (1), (Ref. Fig. 401).

CR (4) Remove bolt (2) then remove P8 connector A, B, or C.

CR (5) P8 Spoke Fairing Check (Ref. Fig. 403)

CR (a) Check for broken P8 rake tubes inside the leading
CR edge of the 5 P8 spoke fairings by inserting a
CR locally-made tool (a NAS6705-29 bolt, TWA S/N

CR 32-3811 is recommended) into each P8 hole until it
CR makes contact with the outer end of the fairing
CR tube. The proper drop dimension for all P8
CR positions except the handling point position at
CR 3:00 is approximately 1-3/4" measured from the
CR exhaust case P8 probe mount surface. The handling
CR point position should measure approximately 2.0"
CR due to the thickness of the handling pad, .300".
CR If the drop is significantly more than 2.0", the
CR outer part of the tube in the fairing is broken
CR off and the P8 probe should be blanked off by
CR welding shut the end of the probe. Contact
CR MCIMD/MCIEE when probe is blanked off.

CR (6) Acceptance Standards

CR (a)	Any P8 probes with cracked or broken tubes	Replace P8 probe
CR (b)	Frettage on the end of the tube provided tube wall thickness is not reduced below .020".	Accept
CR (c)	Frettage in excess of the limits in (b).	Replace P8 probe

CR B. Installation

CR (1) Verify that thrust reverser and associated systems are
CR deactivated and locked (Ref. 78-30-00).

CR (2) Delete

CR (3) Position P8 connector A, and C on turbine case, then
CR install and secure bolts (2) (Ref. Fig. 401).

CR NOTE: Do not use force when installing tube in case.
CR Remove and check for proper alignment.

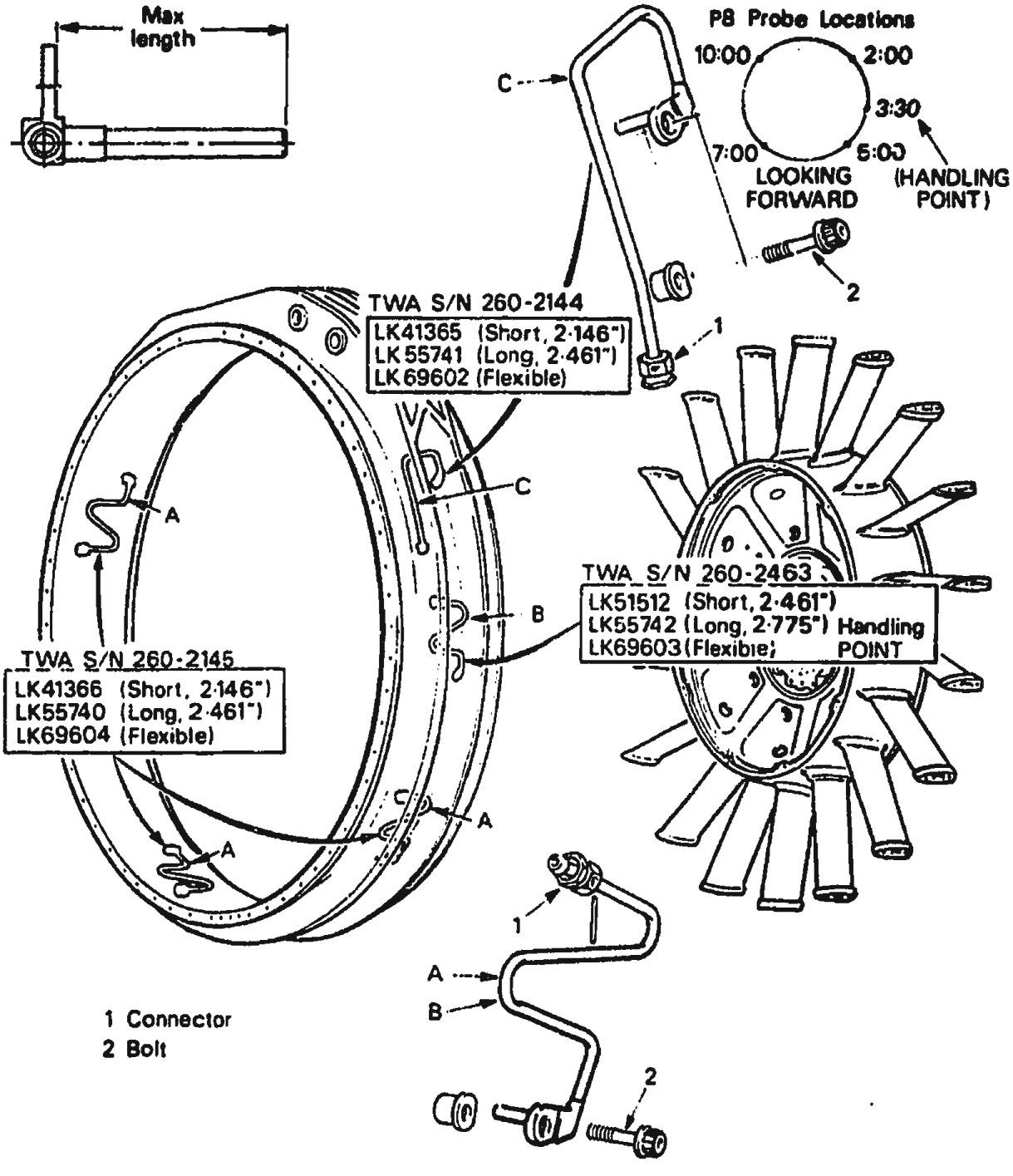
CR (4) Check the P8 Probe at B, the handling point (3 o'clock
CR position looking forward) for proper length (Ref. Fig.
CR 402).

C NOTE: There are two possible lengths depending on S/B
C standard. Ensure that no probes shorter than
C 2.421" are installed at this position.

CR (5) Refer to Fig. 401, install and secure air tube
CR connectors (1), and lockwire (Ref. 70-51-00).

CR (6) Install access panels removed in Step 3A(3).

CR CR (7) Unlock and reactivate thrust reverser and associated systems (Ref. 78-30-00).



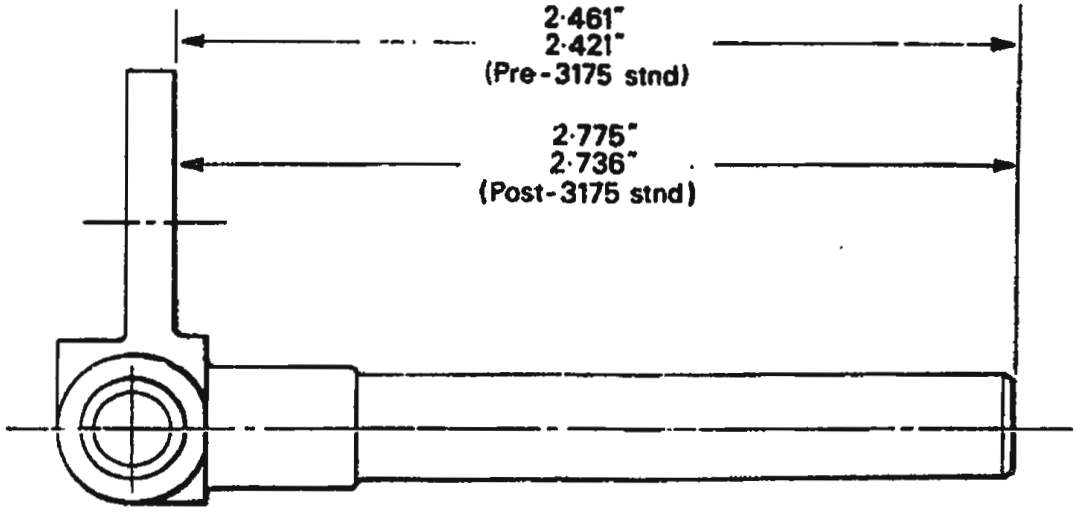
05313
M1-0001-77-204

CR
CR

P8 Probes
Figure 401

EFFECTIVITY: ALL

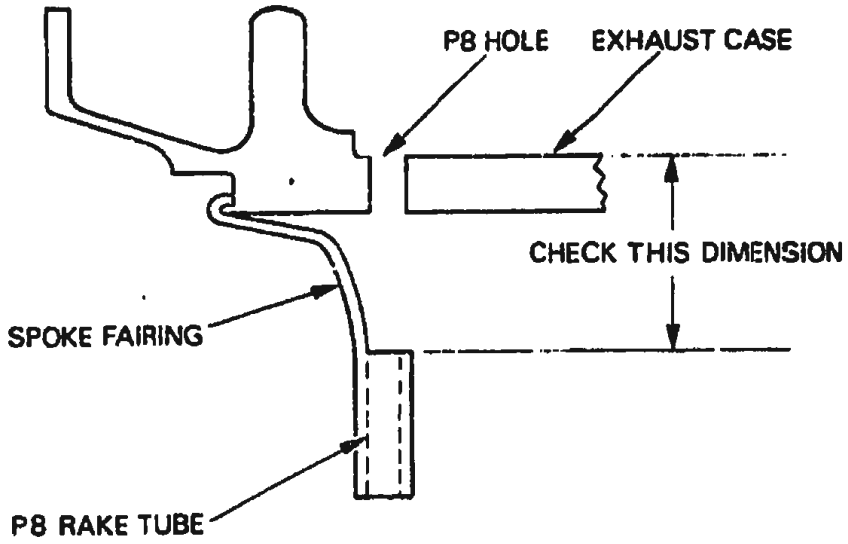
001B



56053
M1-0000-77-283

C
C Handling Point P8 Probe
Figure 402

R EFFECTIVITY: ALL
R
001B


P8 HOLE
EXHAUST CASE
CHECK THIS DIMENSION
SPOKE FAIRING
P8 RAKE TUBE

R P1 PROBE AND TUBE ASSEMBLIES, ENGINE NO. 2 - REMOVAL AND INSTALLATION

1. General

The engine No. 2 P1 probe is located at the midpoint of the S-duct and the integrated engine pressure ratio (IEPR) transmitter is located on the right side of the engine fan case. Tube assemblies connecting these components are routed above the S-duct, through the canted bulkhead firewall at FS 2011.09, around the upper left side of the S-duct adapter to a point just below the centerline of the engine fan case. From a fitting at that point, tube assemblies loop over the top of the fan case to
R mate with the IEPR transmitter. Replace the P1 probe, any single tube assembly or all P1 probe tube assemblies in accordance with this procedure.

2. Equipment and Materials

Lock-wire, MS20995NC20, or equivalent

3. Referenced Procedure

R	20-51-04	Environmental Sealings - Maintenance Practices
R R	54-26-00	Application or Erosion Resistant Coating on Interior of S-Duct - Cleaning and Painting
	71-12-00	Cowling, Engine No. 1 - Maintenance Practices

4. Removal/Installation

A. Removal

(1) Remove access panel 313FR from the right side of the fuselage afterbody, zone 310, to gain access to the area above the S-duct from the midpoint of the duct to the canted bulkhead firewall, zone 439.

(2) Open engine No. 2 hinged cowling panels 433Al and 434AR.

R (3) Remove P1 probe as follows:

R (a) Disconnect P1 probe tube and anti-ice tube from P1
R probe (Ref. Fig. 401).

R (b) Gain access to the inside of the S-duct and
R install applicable access stand (Ref. 54-26-00).

R (c) With one man inside the S-duct supporting the P1
R probe, have a second man on top of the S-duct
R remove the nuts and washers.

R (4) Remove sections of P1 probe tubing requiring replacement (Ref. Fig. 401).

B. Installation

(1) Install tubing assemblies on engine from engine to firewall elbow and from canted bulkhead to P1 probe
R (Ref. Fig. 401).

R (2) Install P1 probe as follows (Ref. Fig. 401):

R (a) Have one man in S-duct position P1 probe into
R position, while other man on top of S-duct
R installs washers and/or nuts as applicable.

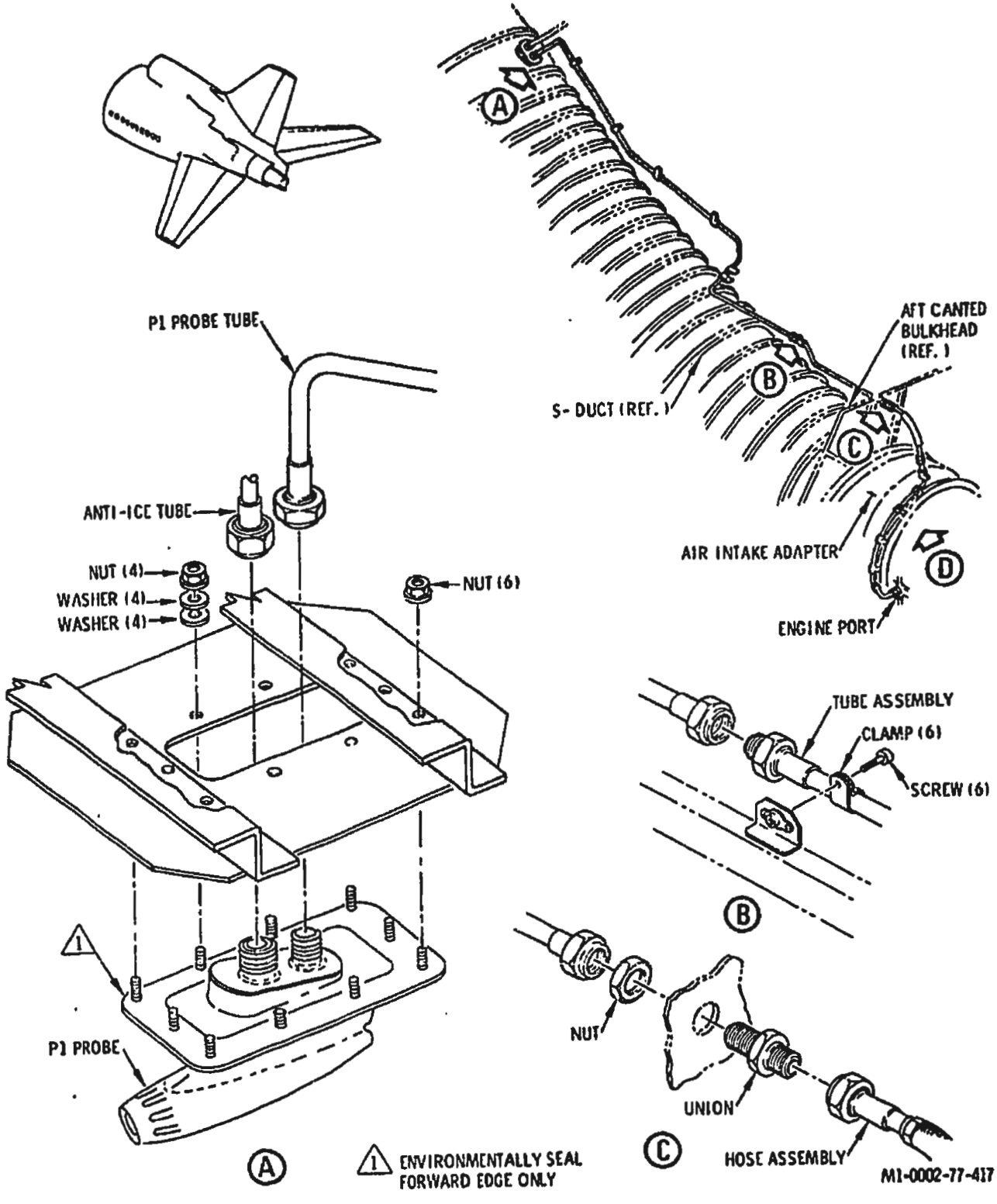
R (b) Aerodynamically apply C-40-1279 sealant to the FWD
R edge of the P1 probe only (Ref. 20-51-04).

R (c) Remove S-duct access stand (Ref. 54-26-00).

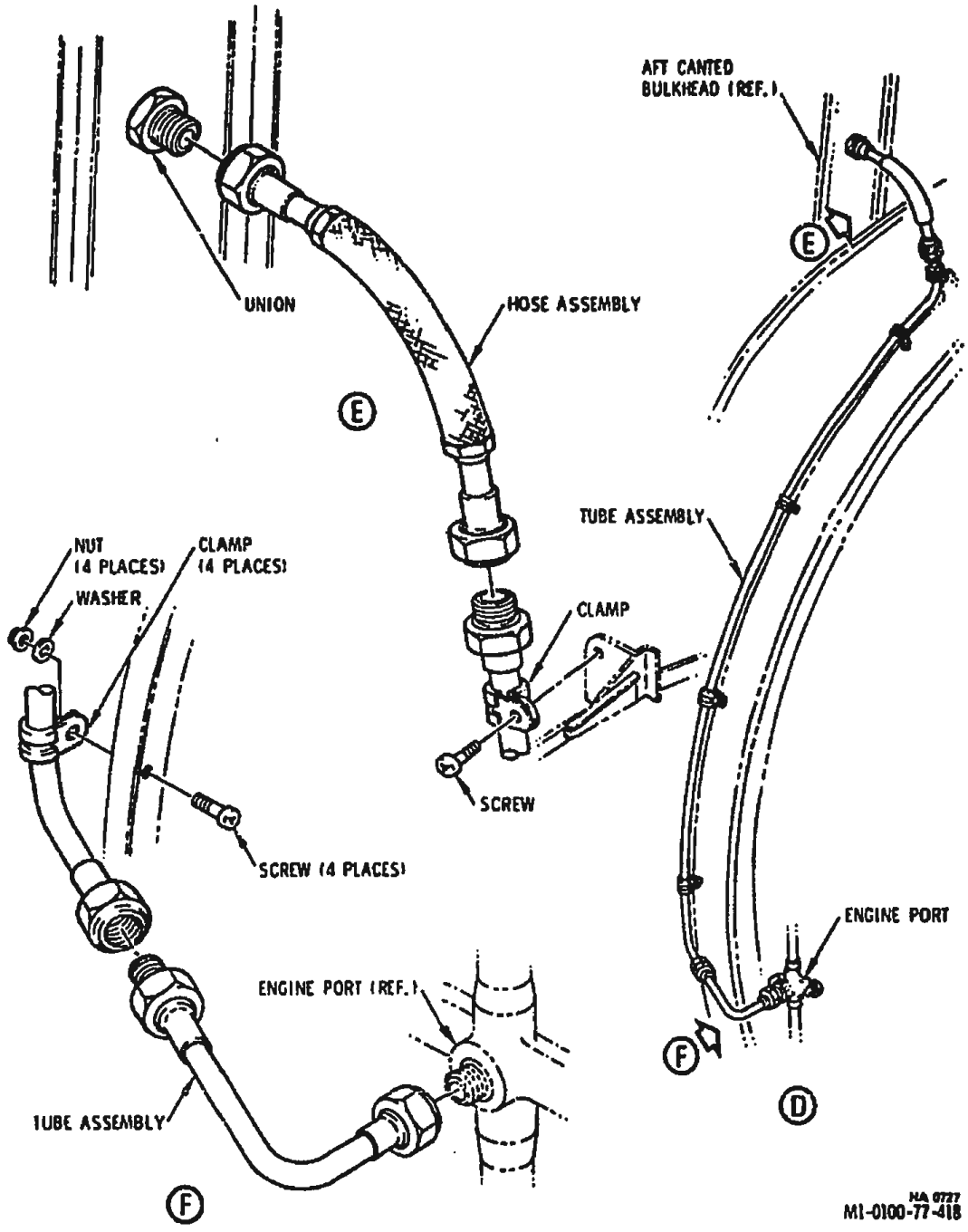
R (d) Install and lock-wire tube assembly fitting(s) at
R juncture with probe.

(3) Close cowl (Ref. 71-12-00).

(4) Install access panel 313FR.



R P1 Probe and Tube Assemblies - Removal and Installation
R Figure 401 (Sheet 1)



R P1 Probe and Tube Assemblies - Removal and Installation
R Figure 401 (Sheet 2)

INTEGRATED ENGINE PRESSURE RATIO (IEPR) TRIMMER UNIT AND HARNESS REMOVAL AND INSTALLATION

1. Equipment and Materials

   Protective Caps

2. Referenced Procedures

   71-11-00 Engines No. 1 and 3 Cowling - Servicing

   71-12-01 LH and RH Lower Hinged Cowl - Servicing

   77-11-14 Integrated Engine Pressure Ratio Trimmer Unit and Harness - Adjustment and Test

3. Removal/Installation - IEPR Trimmer Unit and Harness

   A. Removal

      (1) On Flight Engineers/Second Officers aft circuit breaker panel CB3, zone 215, open and tag applicable circuit breaker EPR IND (L5, L11, or L17).

      (2) Open RH hinged cowl 414A or 424A for engines No. 1 or No. 3 (Ref. 71-11-00), or 434AR for engine No. 2 (Ref. 71-12-01).

      (3) Disconnect electrical connectors (1) and (2) (Ref. Fig. 401)

      (4) Remove harness clip and bolt (3).

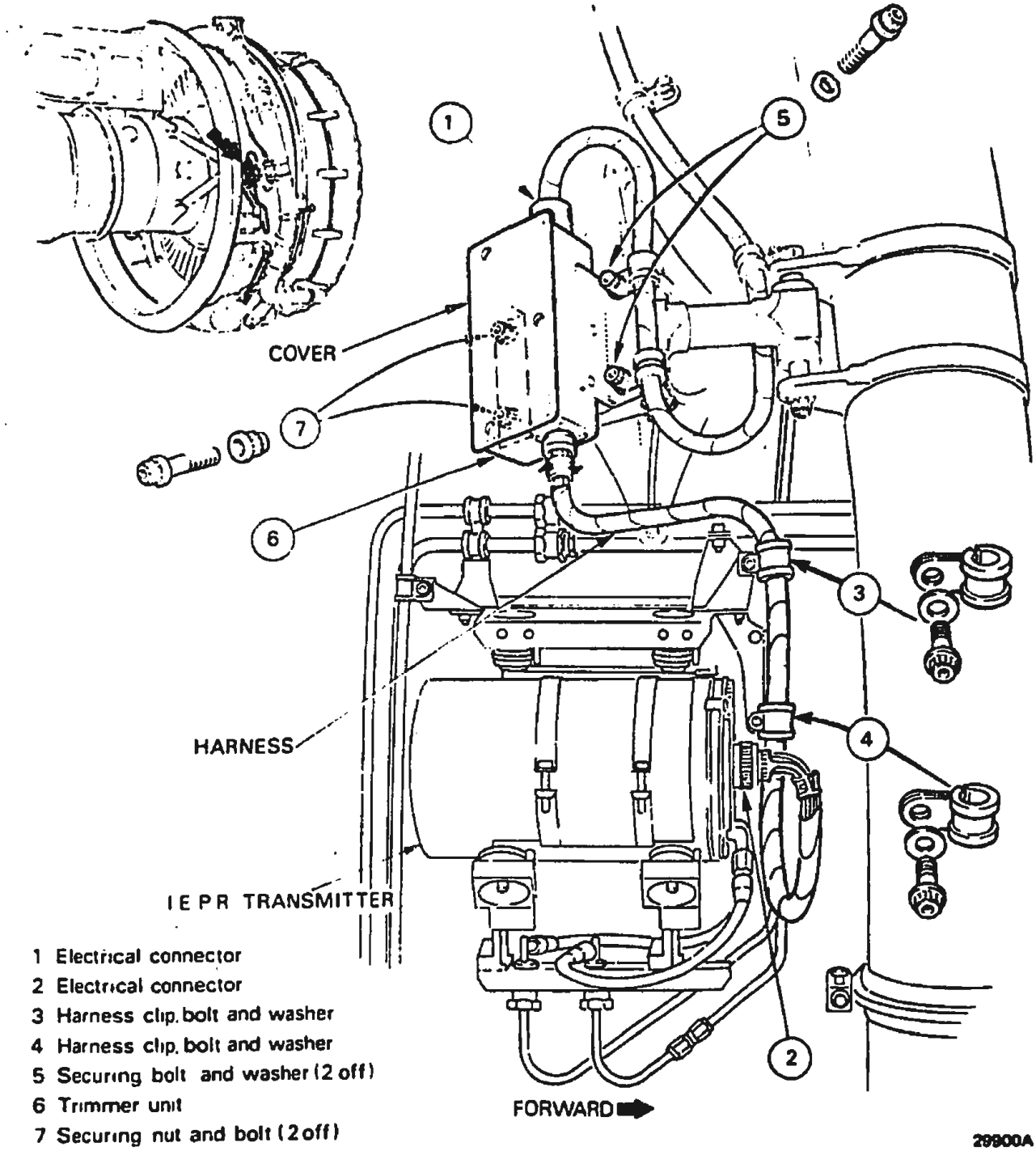
R   (5) On engines with RR SB70-3057, remove bolt, washer, and clip (4).

R   (6) Remove bolts and washers (5), and on engines without RR
R   SB72-3732, leave associated clips attached to harness.

      (7) Support trimmer unit (6), remove bolts and nuts (7) and lift unit off mounting bracket.

      (8) If required, remove resistors as detailed in para 4.A.(3),(4) and (5).

      (9) Install lead terminals and terminal post nuts; install cover and secure quick release fasteners.

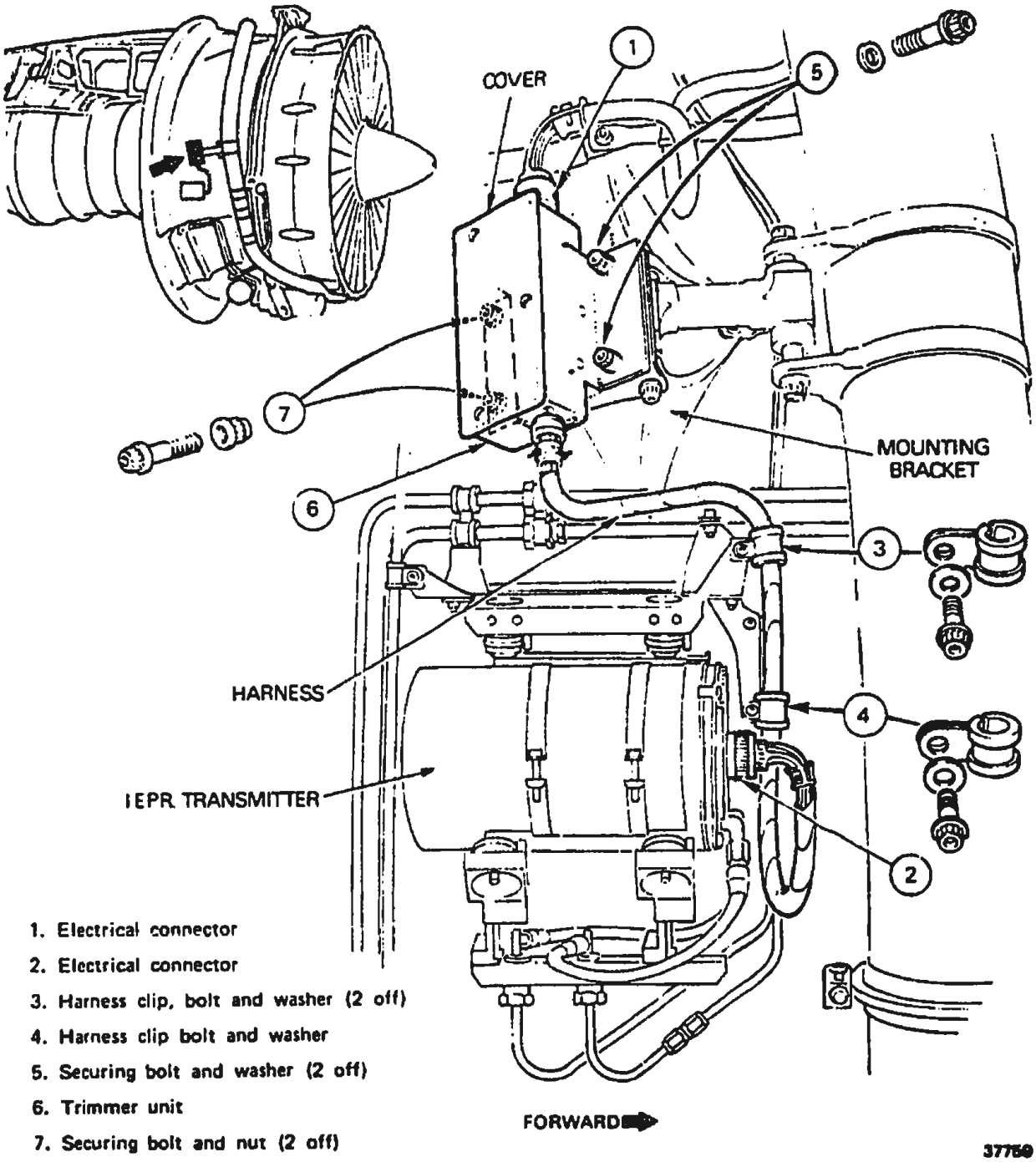


R
R

IEPR Trimmer Unit and Harness
Figure 401

EFFECTIVITY: WITHOUT RR SB72-3732

001B



1. Electrical connector
2. Electrical connector
3. Harness clip, bolt and washer (2 off)
4. Harness clip bolt and washer
5. Securing bolt and washer (2 off)
6. Trimmer unit
7. Securing bolt and nut (2 off)

R
R

IEPR Trimmer Unit and Harness
Figure 401

EFFECTIVITY: WITH RR SB72-3732

001R

(10) Install protective caps to electrical connectors.

B. Installation

(1) Verify that EPR IND circuit breaker is open and tagged.

(2) Remove protective caps from electrical connectors.

R R (3) Place trimmer unit (6) on mounting bracket, on engines without RR SB72-3732, then position harness clip (Ref. Fig. 401) and secure assembly with bolts and nuts (7) and bolts and washers (5).

(4) Position clip (3) on harness and secure with bolt.

R (5) On engines with RR SB70-3057, install bolt, washer, and clip (4).

(6) Connect and secure electrical connectors (2) and (1).

(7) If required, release quick release fasteners and remove trimmer unit cover then install and secure resistors as detailed in para. 4.B(2). Install cover and secure quick release fastners.

NOTE: The trimmer resistor is identified by a code letter (A to J) on one of the terminal lugs. To confirm code letter of trimmer resistor being installed in correct, refer to engine data slip plate and read code letter against IEPR TRIMMER CODE. If plate is not annotated IEPR TRIMMER CODE, read code letter against BALLAST RESISTOR CODE.

(8) Close circuit breaker opened in Step 3A(1).

(9) Close hinged cowl.

4. Removal/Installation - Trimmer Resistor and 8000-ohm Resistor

A. Removal

(1) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag applicable circuit breaker EPR IND (L5, L11, or L17).

(2) Open RH hinged cowl 414A or 424A for engines No. 1 or No. 3 (Ref. 71-11-00), or 434AR for engine No. 2 (Ref. 71-12-01).

(3) Release quick-release fasteners and remove cover (Ref. Fig. 402).

(4) Remove securing nuts from terminal posts 1, 2, and 3.

(5) Remove lead terminals and resistors from terminal posts.

B. Installation

(1) Verify that EPR IND circuit breaker is open and tagged.

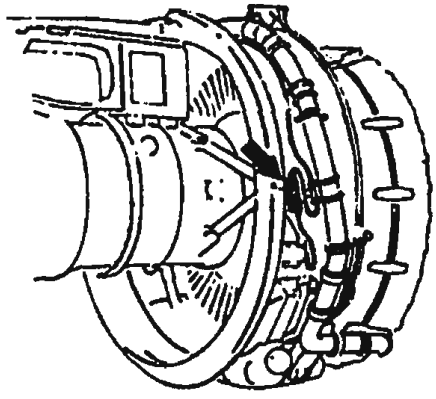
(2) Install 8000-ohm resistor, trimmer resistor, and lead terminals to terminal posts in order shown (Ref. Fig. 402) and secure with terminal post nuts.

NOTE: Terminal post 1 is of smaller diameter to prevent incorrect installation of 8000-ohm resistor.

(3) Install cover and secure quick-release fasteners.

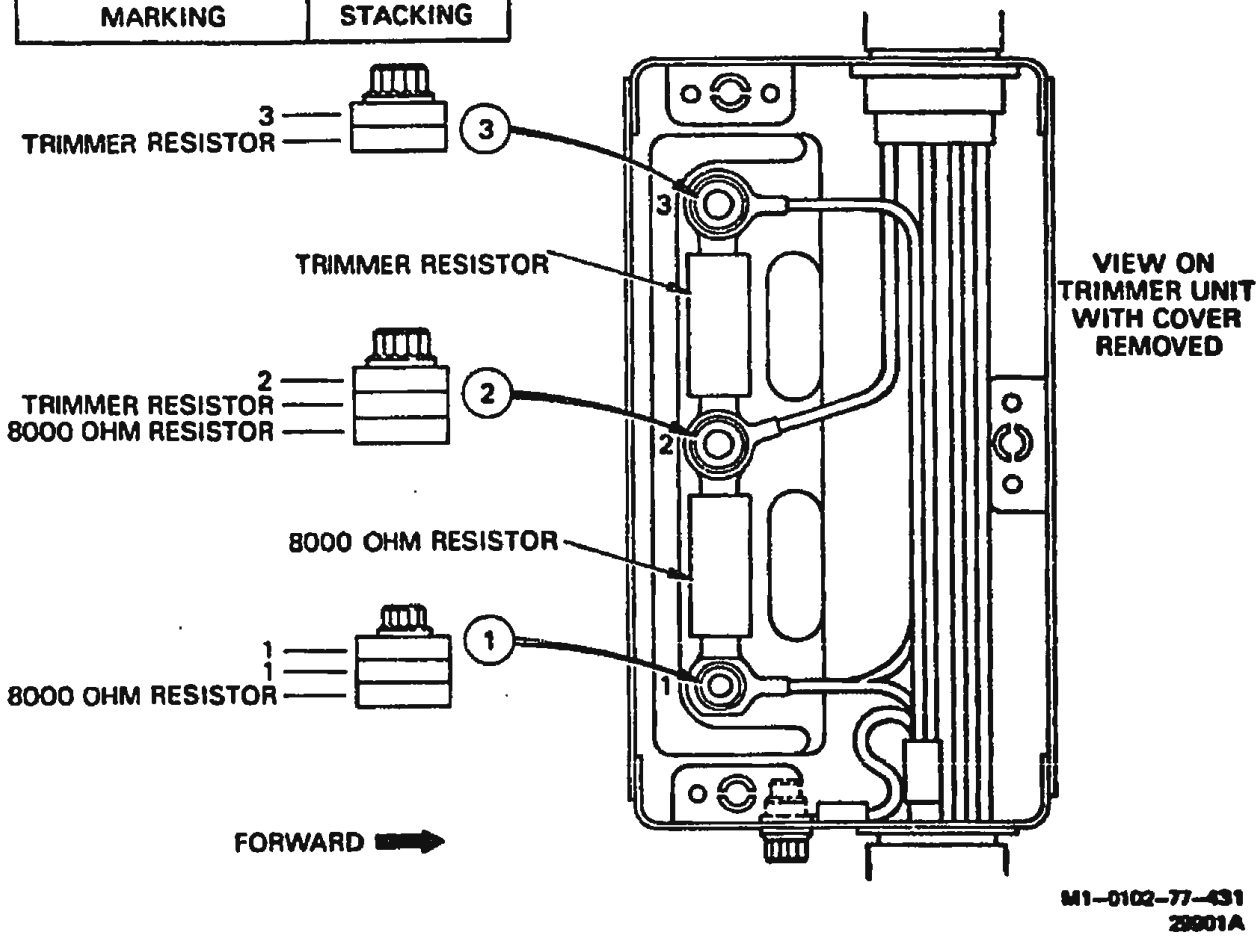
(4) Close circuit breaker opened in Step 4A(1).

(5) Close hinged cowl.



TRIMMER RESISTOR	
CODE LETTER	RESISTANCE (Ohms)
A	30 ± 0·30
B	48 ± 0·48
C	74 ± 0·74
D	102 ± 1·02
E	134 ± 1·34
F	168 ± 1·68
G	200 ± 2·00
H	240 ± 2·40
J	270 ± 2·70

LEAD MARKING	TERMINAL STACKING



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29801A

Resistor Removal and Installation
Figure 402

INTEGRATED ENGINE PRESSURE RATIO (IEPR) TRIMMER UNIT AND HARNESS ADJUSTMENT AND TEST

1. Equipment and Materials

Wheatstone bridge or similar test instrument fitted with test leads of known resistance value. Ensure test leads are equipped with correct socket or pin end fittings.

2. Referenced Procedures

71-11-00	Engines No. 1 and No. 3 Cowling - Servicing
71-12-01	LH and RH Lower Hinged Cowl - Servicing
77-11-14	Integrated Engine Pressure Ratio Trimmer Unit and Harness - Removal and Installation

3. Adjustment/Test

A. Resistance Test of Trimmer Unit and Harness

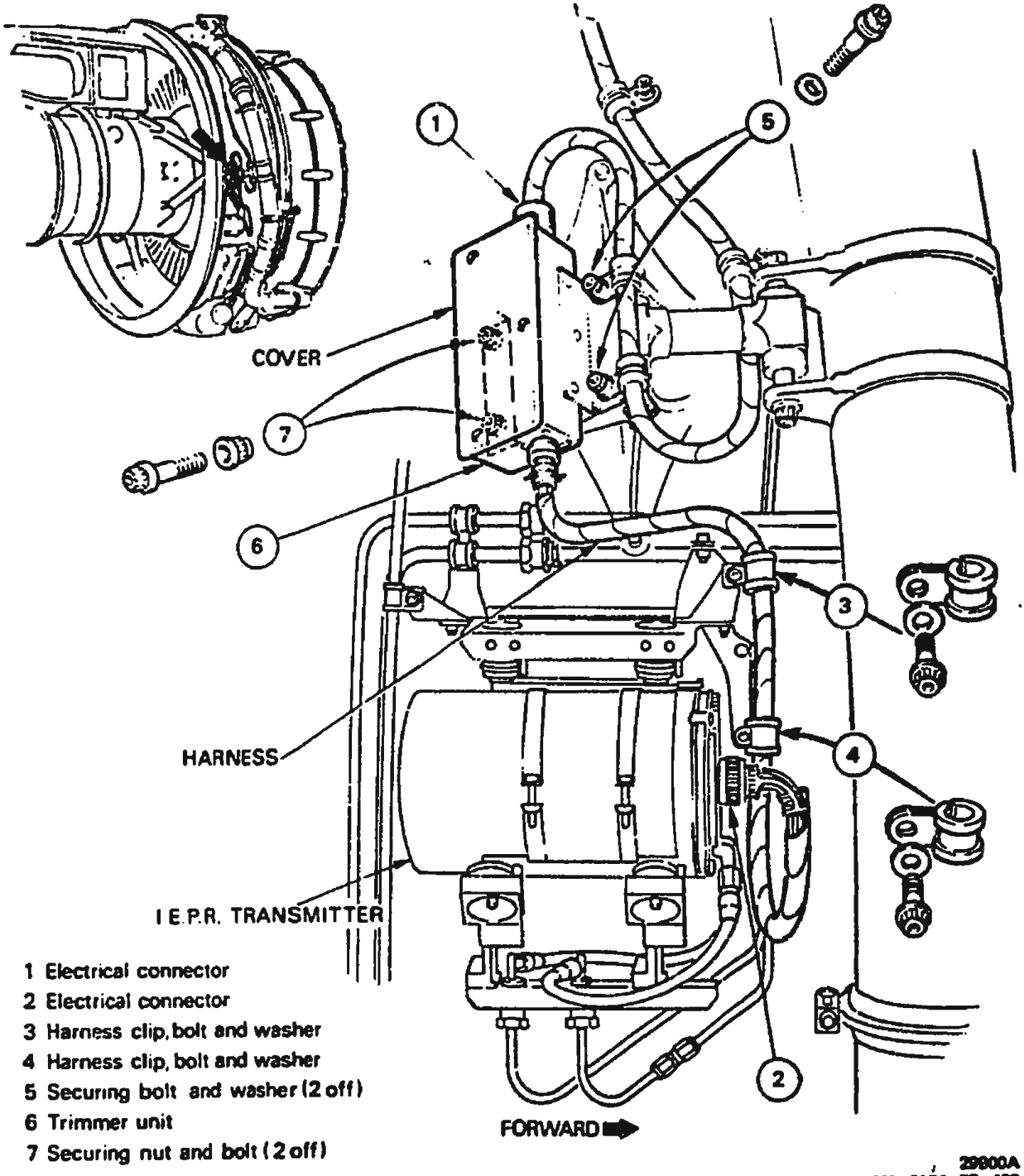
(1) On Flight Engineer/Second Officer aft circuit breaker panel CB3, zone 215, open and tag applicable circuit breaker EPR IND (L5, L11, or L17).

(2) Open RH hinged cowl 414A or 424A for engines No. 1 or No. 3 (Ref. 71-11-00), or 434AR for engine No. 2 (Ref. 71-12-01).

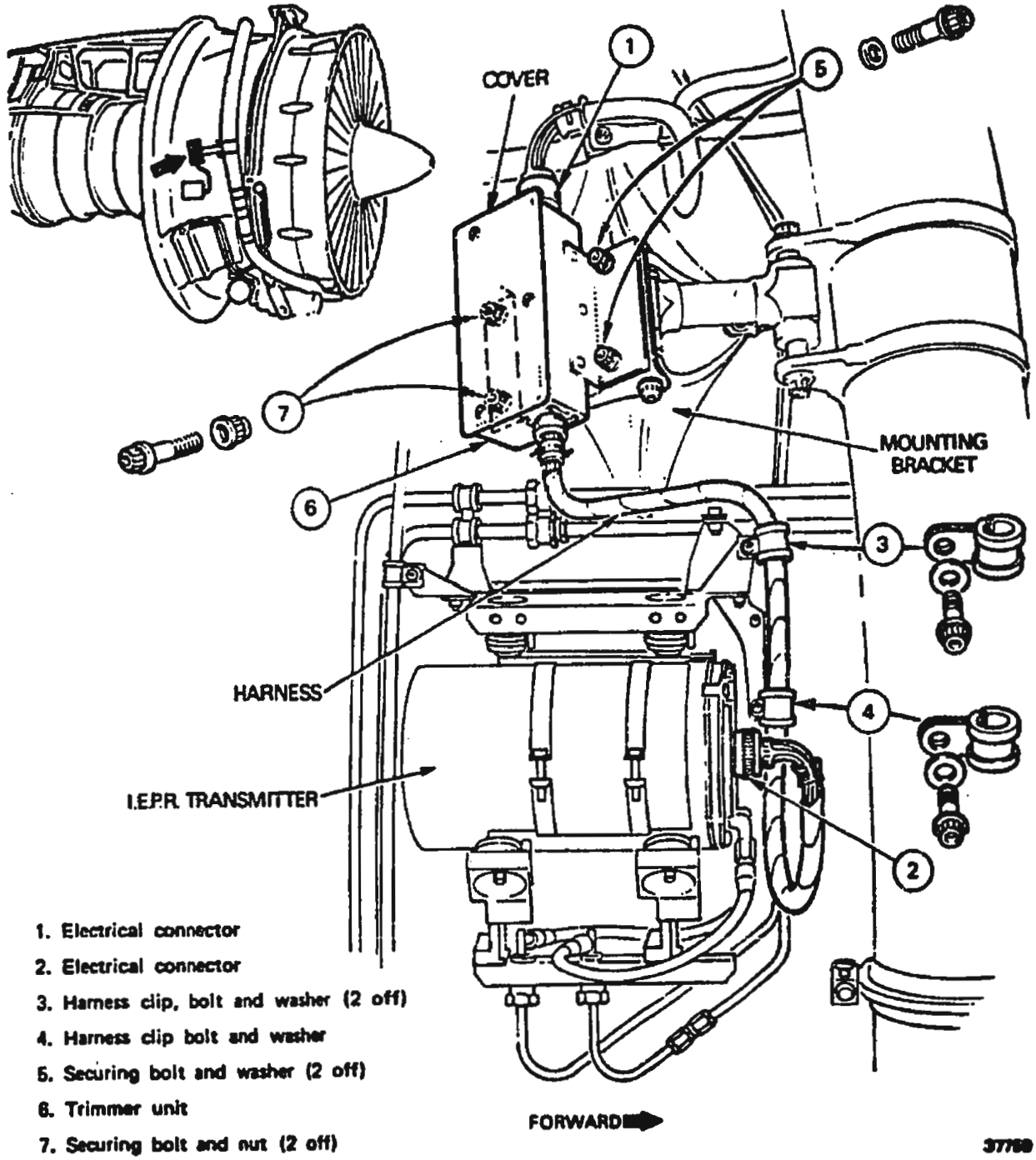
(3) Disconnect electrical connectors (1) and (2) (Ref. Fig. 501).

(4) Prepare for resistance tests (Ref. Table 501); connect one lead from Wheatstone bridge to appropriate receptacle pin exposed by removal of electrical connector (1) and other lead to appropriate socket in electrical connector (2) (Ref. Fig. 501).

(5) Carry out resistance tests detailed in table 501 subtracting resistance value of test leads from instrument reading in each case.



IEPR Trimmer Unit and Harness
Figure 501



1. Electrical connector
2. Electrical connector
3. Harness clip, bolt and washer (2 off)
4. Harness clip bolt and washer
5. Securing bolt and washer (2 off)
6. Trimmer unit
7. Securing bolt and nut (2 off)

R
R

IEPR Trimmer Unit and Harness
Figure 501

EFFECTIVITY: WITH RR SB72-3732

001B

Resistance Tests
Table 501

PIN	TO	SOCKET	RESISTANCE (Ohms)
1		3	8000±80
1		1	*trim resistor
3		1	8000 ±80 + *trim resistor

* To establish code letter of trimmer resistor, refer to engine data slip plate and read code letter against IEPR TRIMMER CODE. If plate is not annotated IEPR TRIMMER CODE, read letter against BALLAST RESISTOR CODE then refer to TABLE 502 for value of trimmer resistor.

(6) Connect electrical connectors (2) and (1).

(7) Close circuit breaker opened in Step 3A(1).

(8) Close hinged cowl.

B. Resistance Test of Trimmer Resistor and 8000-ohm Resistor

Test leads must be connected directly to the resistor under test with nuts and bolts. Probes or crocodile clips are not satisfactory.

(1) Remove trimmer resistor and 8000-ohm resistor (Ref. 77-11-14).

(2) Connect test leads to trimmer resistor terminals.

R NOTE: The trimmer resistor is identified by a code letter (Table 502) on one of the terminal lugs. To confirm letter is correct, refer to engine data slip plate and read code letter against IEPR TRIMMER CODE. If plate is not annotated IEPR TRIMMER CODE, read code letter against BALLAST RESISTOR CODE. Then refer to TABLE 502 for code letter resistance value.

(3) Measure resistance of trimmer resistor. This will be dependant on value of resistor fitted. Subtract value of test leads from instrument reading.

(4) Disconnect test leads from trimmer resistor and connect to 8000-ohm resistor terminals.

NOTE: The 8000-ohm resistor is identified by the code letter Z on one of the terminal lugs.

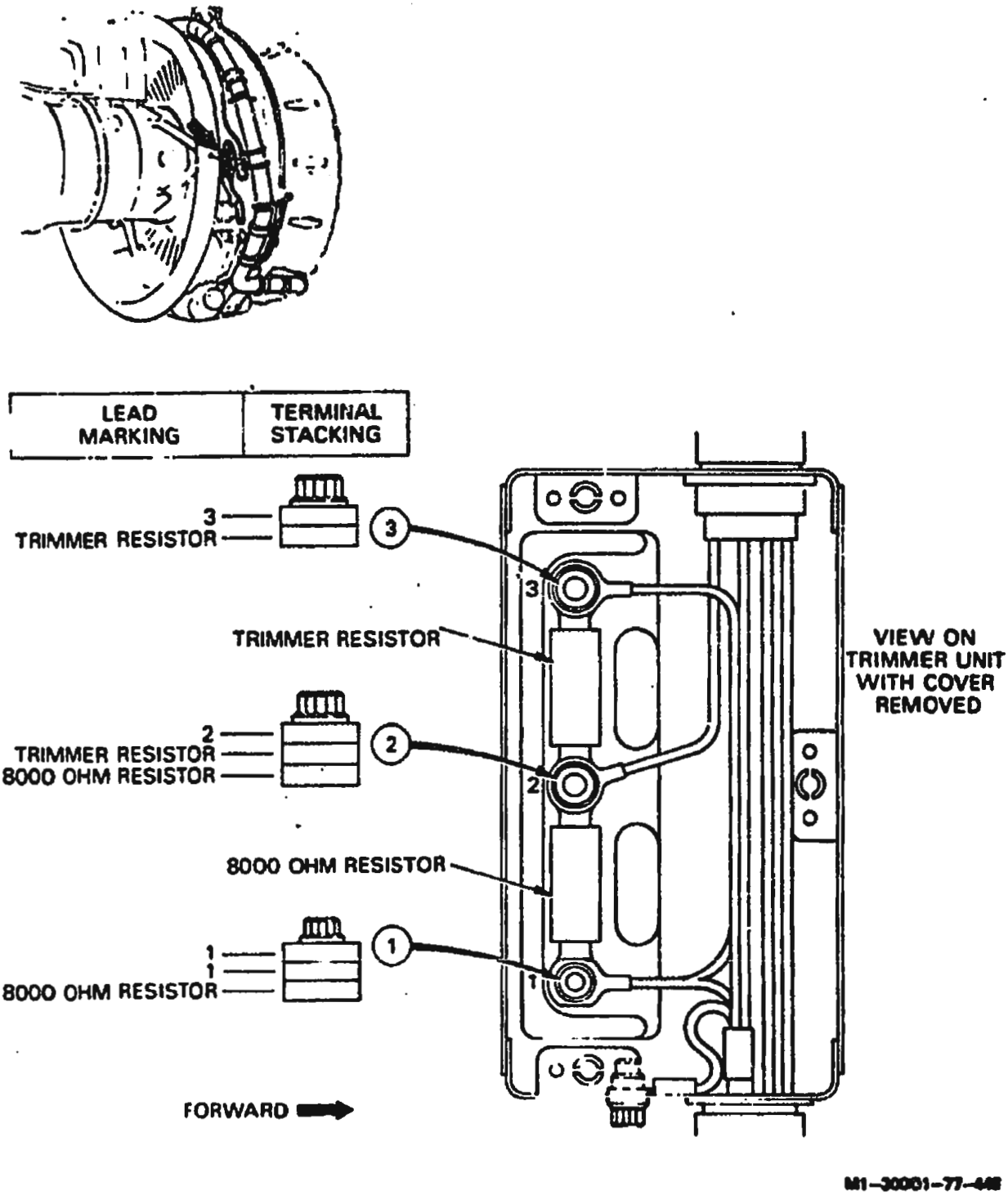
(5) Measure resistance of 8000-ohm resistor. This should be 8000 (±80) ohms. Subtract resistance value of test leads from instrument reading.

(6) Disconnect test leads from 8000-ohm resistor terminals.

(7) Install trimmer resistor and 8000-ohm resistor (Ref. 77-11-14).

TRIMMER RESISTOR CODE/VALUE
TABLE 502

CODE LETTER	RESISTANCE (OHMS)
A	30 ± 0.30
B	48 ± 0.48
C	74 ± 0.74
D	102 ± 1.02
E	134 ± 1.34
F	168 ± 1.68
G	200 ± 2.00
H	240 ± 2.40
J	270 ± 2.70
P	5 ± 0.05



Trimmer Resistor and 8000-ohm Resistor
Figure 502

ENGINE SHAFT SPEED INDICATING SYSTEM - DESCRIPTION AND OPERATION

1. General

Engine compressor module shaft rotational speeds for the RB.211 engine are sensed and displayed by the components of the engine shaft speed indicating system (Ref. Fig. 1). Low-pressure (LP), intermediate-pressure (IP), and high-pressure (HP) module performances are all measured for effective operation of the engines.

Two vertical-scale indicators on the pilots instrument panel, zone 210, display LP and HP module shaft speeds (N1 and N3 compressors, respectively). Shaft speed of the IP module (N2 compressor) is presented by three dial indicators on the Flight Engineer/Second Officers ENGINE STATUS panel, zone 215.

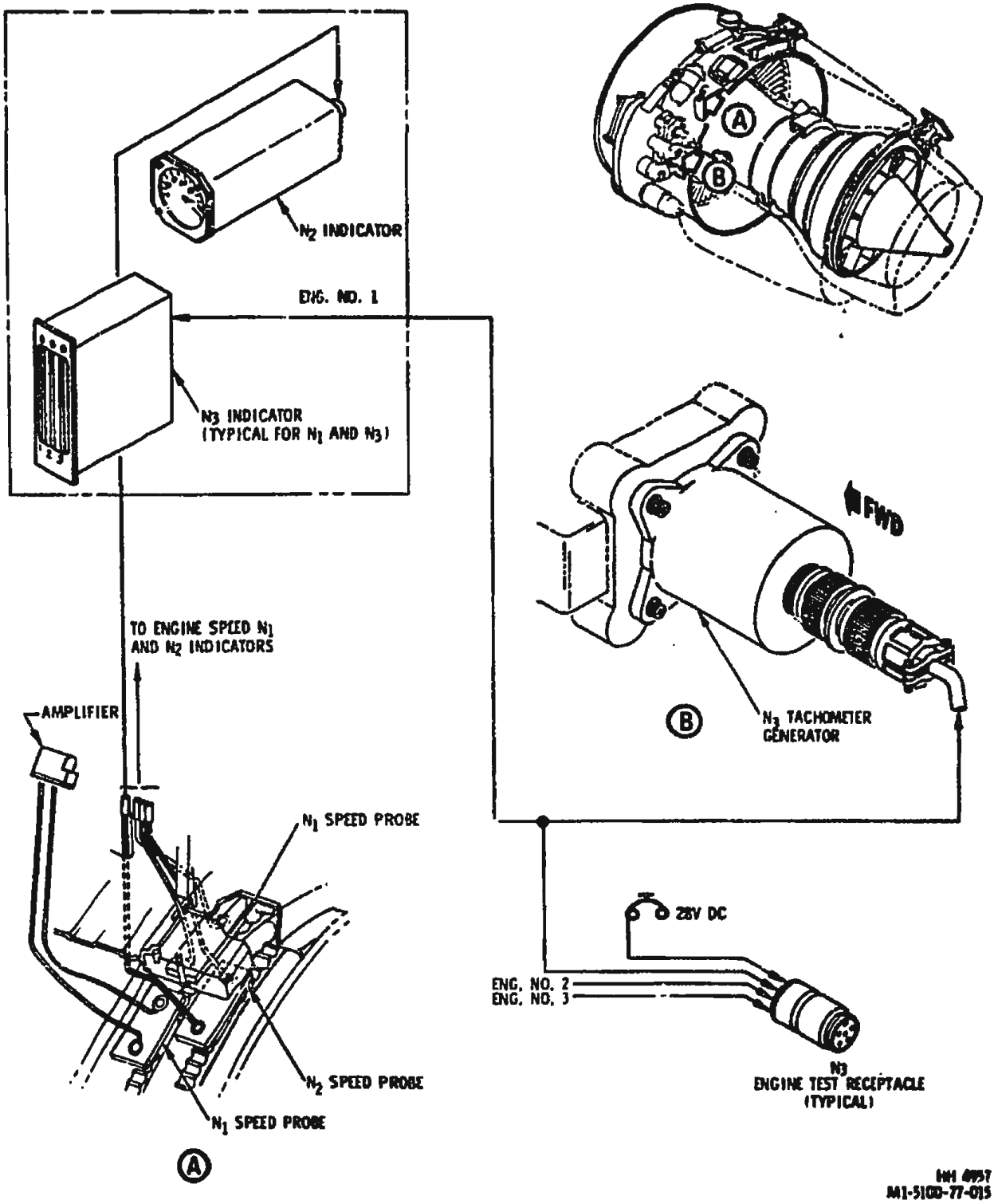
The speeds of the three rotating shaft assemblies are separately measured and then indicated in the flight station, as a percentage equivalent of the rotational speed (rpm).

The engine-mounted units of the system (Ref. Fig. 2) consist of two LP shaft speed pulse probes, two IP shaft speed pulse probes and an HP tachometer generator located in zones 412, 422 and 432.

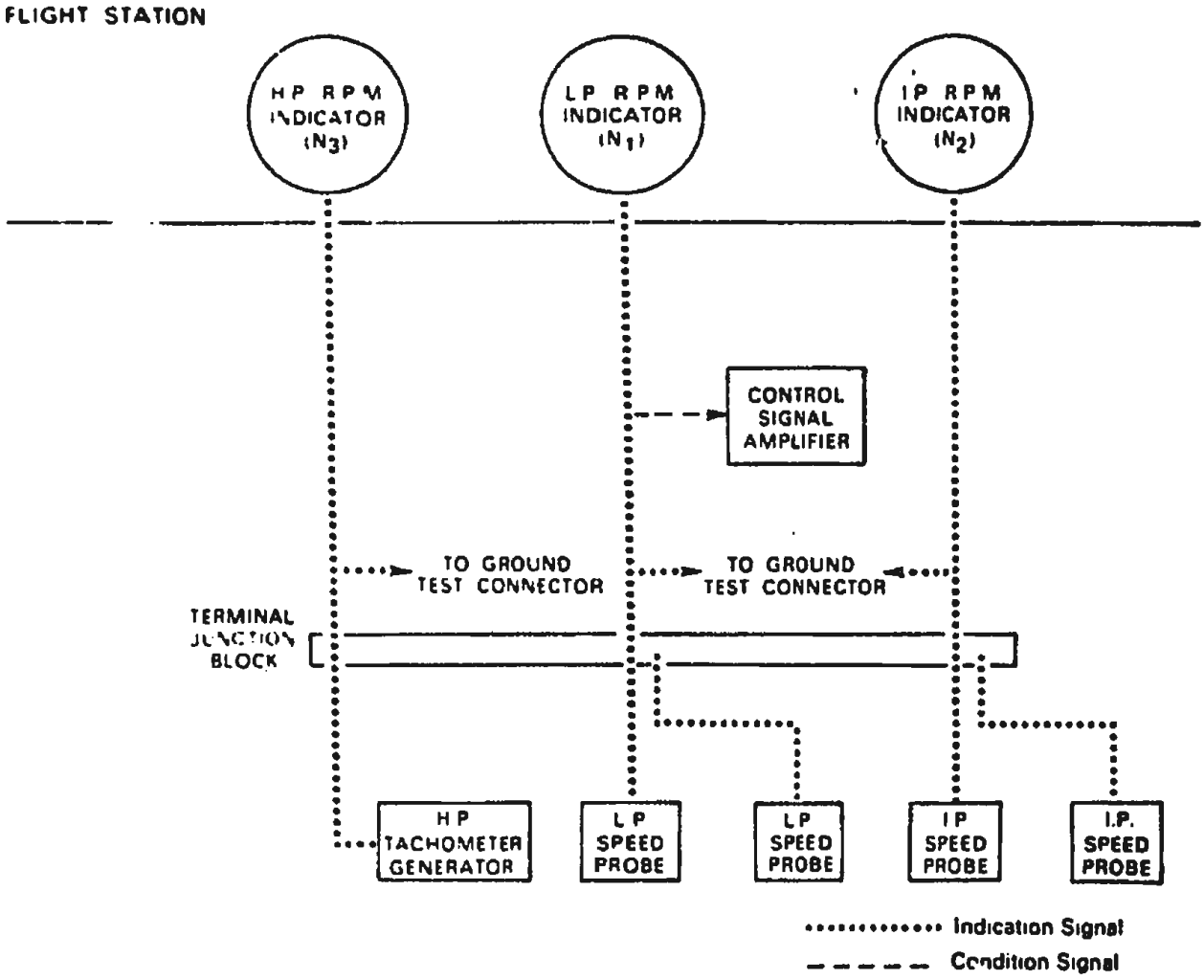
The four probes are identical and are of the variable reluctance type with magnetic discontinuity being provided through a phonic wheel. The probes are mounted circumferentially in pairs on terminal block assemblies inside the front bearing housing, so that they align with the relevant LP or IP phonic wheel. The phonic wheels are integral parts of the LP compressor shaft and IP compressor front stub shaft.

Rotation of the shaft causes the teeth on the periphery of each phonic wheel to pass its speed probes once per revolution. This causes a voltage to be induced in a coil within the probe and an electrical signal is produced, the frequency of which is therefore directly proportional to the speed of rotation of the shaft phonic wheel.

Two conduits from the terminal block assemblies pass through flanged connectors and two of the IP compressor fixed inlet guide vanes (Ref. Fig. 3). Two wires from each probe pass through the conduits and connect to terminal blocks, one LP and one IP, on the front bearing housing. The terminal blocks are connected, through the engine electrical harness (Ref. 71-50-00), to a terminal junction block on the LP compressor case. From the junction block the LP and IP shaft speed wiring



Engine Shaft Speed Indicating System
Figure 1



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R
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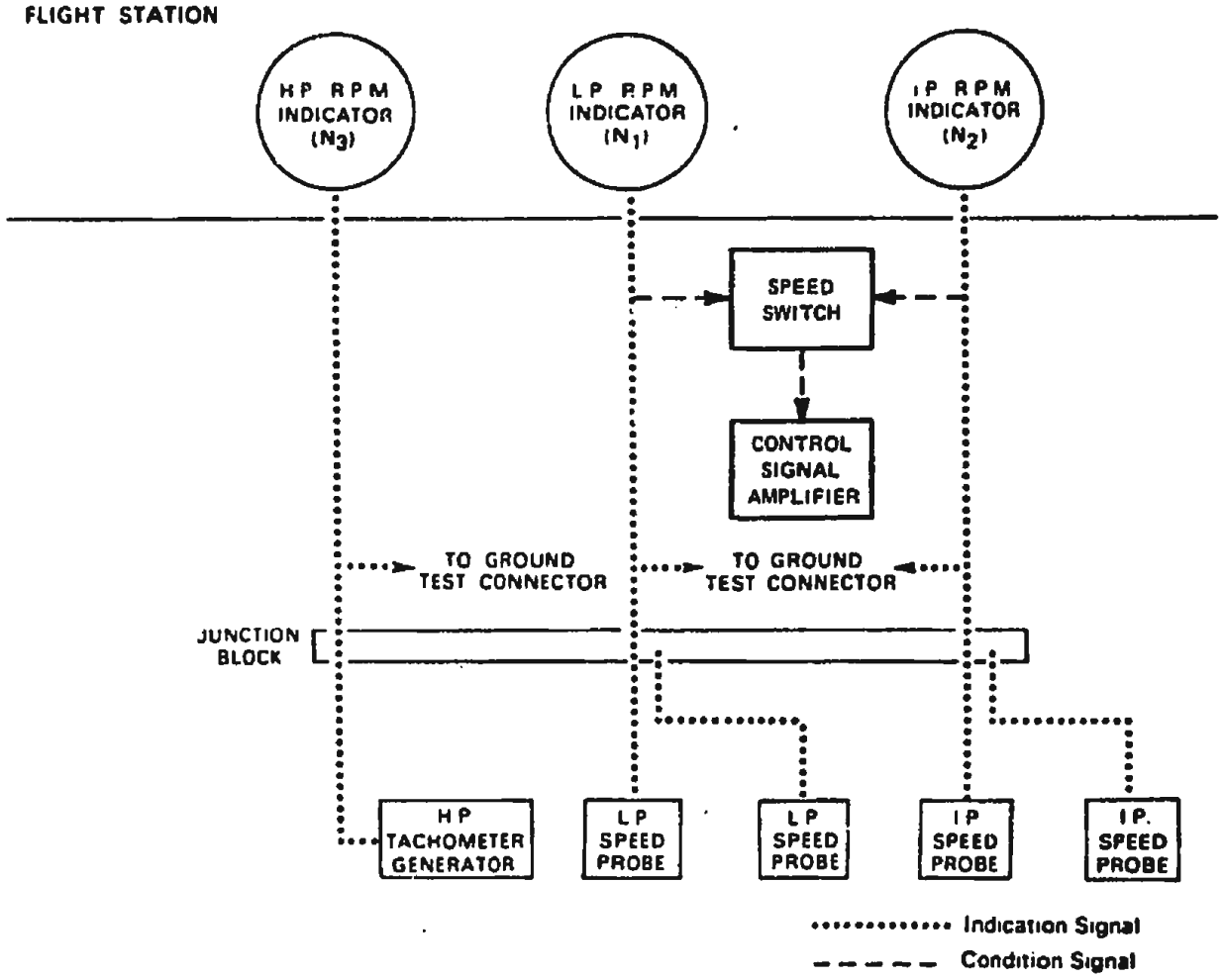
Engine Shaft Speed Diagram
Figure 2

EFFECTIVITY: ENGINES WITHOUT RR SB73-2575



HA 2855
M1-0100-77-067
29938

R
R

Engine Shaft Speed Diagram
Figure 2

EFFECTIVITY: ENGINES WITH RR SB73-2575

is connected to the engine ground test connector and to the engine/aircraft disconnect point (Ref. Fig. 2).

On engines with SB 73-2575 (IP Compressor Speed Governor Unit), the LP and IP shaft speed wiring is also connected to the control signal amplifier through the speed switch (Ref. 73-21-00).

R On engines without RR SB73-2575,
R the LP shaft speed wiring is also connected to the control signal amplifier (Ref. 73-21-00).

Only one of each pair of speed pulse probes is connected into the indicator circuit, the other being available as an alternate for use in the event of failure of the connected probe. The wiring of the alternative probes terminates at the terminal junction block, where the change over is made if it is required to connect either of the alternative probes into the circuit.

The HP tachometer generator is mounted on and driven from the high-speed external gearbox. It is a single-phase generator having a 12-pole permanent magnet rotor. Rotation of the HP (N3) shaft assembly drives the high-speed gearbox (Ref. 72-00-00), and thus the tachometer generator. The frequency of the alternating signal induced in the stator coil is, therefore, directly proportional to the HP shaft speed.

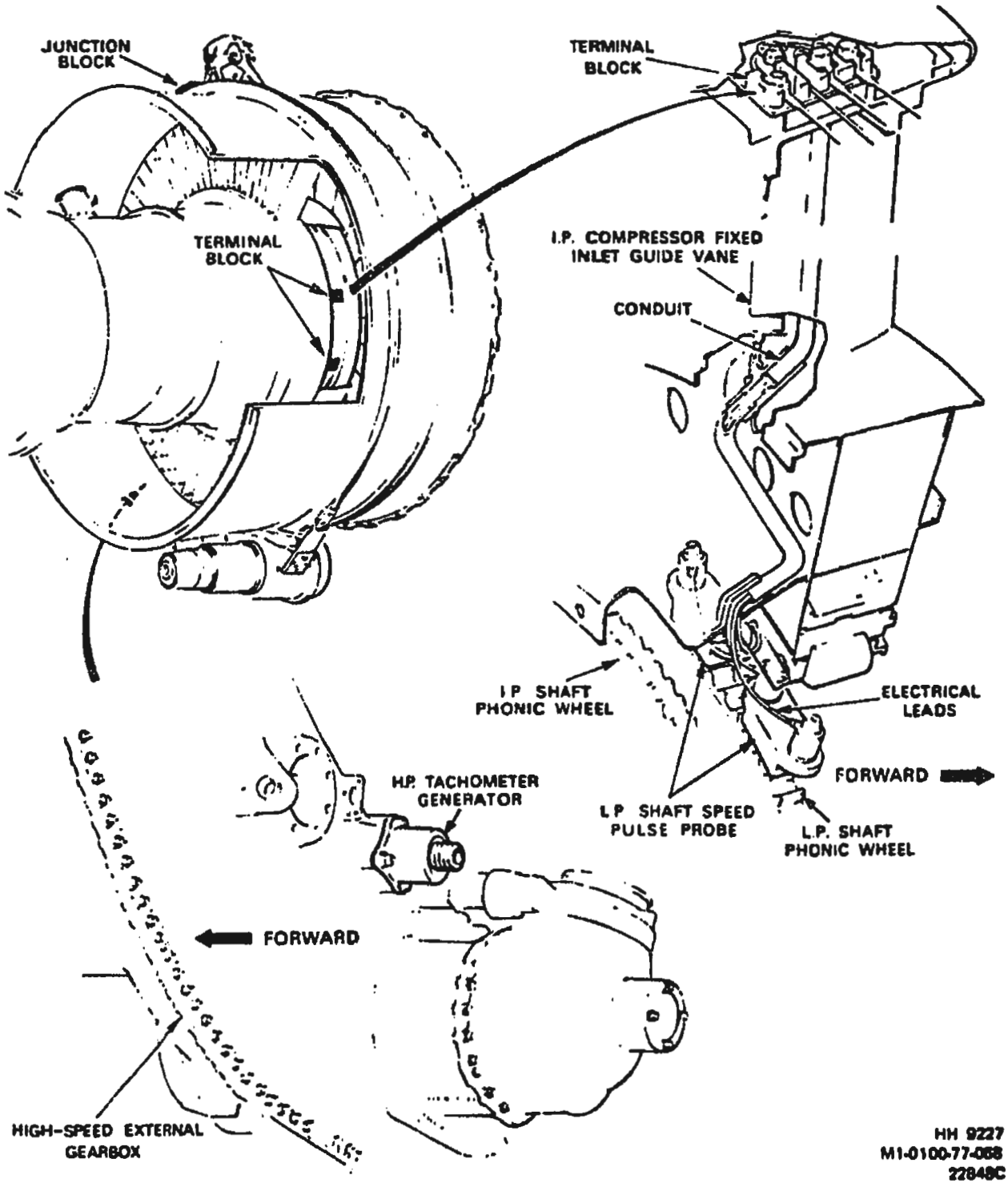
The generator is connected, through the engine electrical harness (Ref. 71-51-00), to the junction block on the LP compressor case. From the junction block the generator leads are connected to the engine/aircraft disconnect point and the engine ground test connector. The generator is mounted between the input drive bevel gear housing and the fuel control unit. Signal output from the generator is converted and displayed on the pilots N3 indicator (Ref. Fig. 4).

2. LP_and_IP_Shaft_Speed_Pulse_Probes

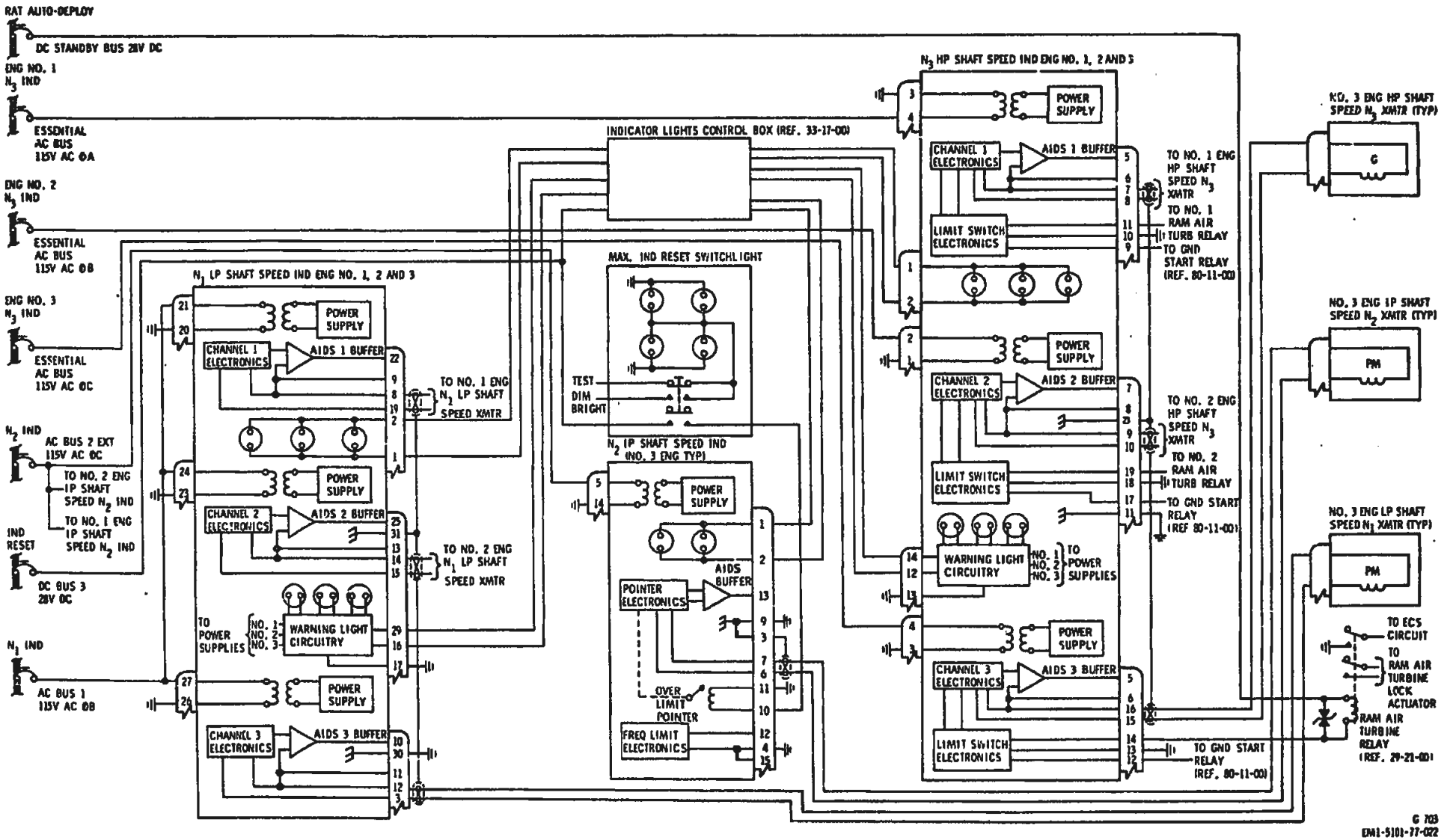
A. Description and Operation

Two LP (N1) compressor shaft speed pulse probes (Ref. Fig. 3) are installed. They are positioned in line with the LP compressor phonic wheel and are secured to a terminal block assembly located on the inside of the front bearing housing, zones 412, 422 and 432.

The probe (Ref. Fig. 5) consists of two permanent magnets, three pole pieces and a coil assembly. The entire assembly is encapsulated in a mineral epoxy resin. The spacing of the pole pieces is equal to the pitch of the teeth on the phonic wheel. The gap between the pole pieces and the



Engine-Mounted Shaft Speed Units
Figure 3


RAT AUTO-DEPLOY
DC STANDBY BUS 28V DC
ENG NO. 1 N3 IND
ESSENTIAL AC BUS 115V AC ØA
ENG NO. 2 N3 IND
ESSENTIAL AC BUS 115V AC ØB
ENG NO. 3 N3 IND
ESSENTIAL AC BUS 115V AC ØC
N2 IND
AC BUS 2 EXT 115V AC ØC
TO NO. 2 ENG IP SHAFT SPEED N2 IND
TO NO. 1 ENG IP SHAFT SPEED N2 IND
IND RESET
DC BUS 3 28V DC
N1 IND
AC BUS 1 115V AC ØB
N1 LP SHAFT SPEED IND ENG NO. 1, 2 AND 3
POWER SUPPLY
CHANNEL 1 ELECTRONICS
AIDS 1 BUFFER
TO NO. 1 ENG N1 LP SHAFT SPEED XMTR
CHANNEL 2 ELECTRONICS
AIDS 2 BUFFER
TO NO. 2 ENG N1 LP SHAFT SPEED XMTR
TO POWER SUPPLIES
NO. 1
NO. 2
NO. 3
WARNING LIGHT CIRCUITRY
CHANNEL 3 ELECTRONICS
AIDS 3 BUFFER
INDICATOR LIGHTS CONTROL BOX (REF. 33-17-00)
MAX. IND RESET SWITCH/LIGHT
TEST
DIM
BRIGHT
N2 IP SHAFT SPEED IND (NO. 3 ENG TYP)
AIDS BUFFER
POINTER ELECTRONICS
OVER LIMIT POINTER
FREQ LIMIT ELECTRONICS
N3 HP SHAFT SPEED IND ENG NO. 1, 2 AND 3
LIMIT SWITCH ELECTRONICS
TO NO. 1 ENG HP SHAFT SPEED N3 XMTR
TO NO. 1 RAM AIR TURB RELAY
TO GND START RELAY (REF. 80-11-00)
TO NO. 2 ENG HP SHAFT SPEED N3 XMTR
TO NO. 2 RAM AIR TURB RELAY
TO GND START RELAY (REF 80-11-00)
WARNING LIGHT CIRCUITRY
TO POWER SUPPLIES
NO. 3 ENG HP SHAFT SPEED N3 XMTR (TYP)
NO. 3 ENG IP SHAFT SPEED N2 XMTR (TYP)
NO. 3 ENG LP SHAFT SPEED N1 XMTR (TYP)
TO ECS CIRCUIT
TO RAM AIR TURBINE LOCK ACTUATOR
RAM AIR TURBINE RELAY (REF. 29-21-00)
G 703
EM1-5101-77-022

Engine Shaft Speed Indicating System Schematic
Figure 4

EFFECTIVITY: ALL

teeth, when directly opposite, provides a path of relatively low reluctance. When the phonic wheel rotates to bring the teeth between the pole pieces, a path of greater reluctance exists. The resultant flux change in the magnetic circuit induces a voltage into the coil and a pulse is produced at the output terminals. The pulse frequency is equal to the rate at which the teeth pass the pole pieces and is, therefore, directly proportional to the speed of rotation of the LP compressor shaft phonic wheel.

Two IP compressor shaft speed pulse probes are fitted. They are positioned in line with the IP compressor shaft phonic wheel and are secured to a terminal block assembly located on the inside of the front bearing housing, zones 412, 422 and 432.

Each probe is identical to the LP probe in construction and operation, except that the frequency of the pulse produced is directly proportional to the speed of rotation of the IP compressor shaft phonic wheel.

3. HP Tachometer Generator

A. Description and Operation

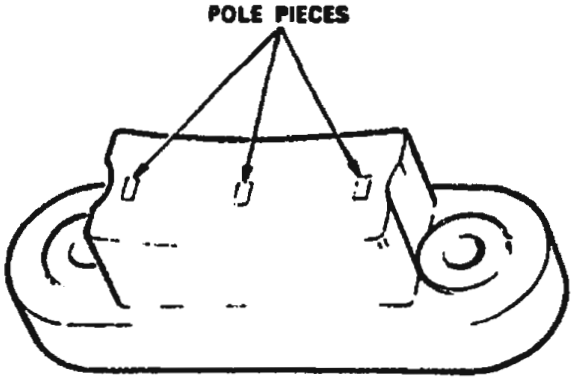
The HP tachometer generator (Ref. Fig. 1 and 3) is mounted on the high-speed external gearbox, zones 412, 422 and 432. The generator consists of a case housing a 12-pole permanent magnet rotor supported on ball bearings within a single-phase stator. One end of the rotor shaft forms a self-aligning square drive that engages with a drive in the high-speed external gearbox. A flange provides a mounting for the generator to the gearbox and an electrical receptacle provides a connection to the engine electrical harness (Ref. 71-50-00).

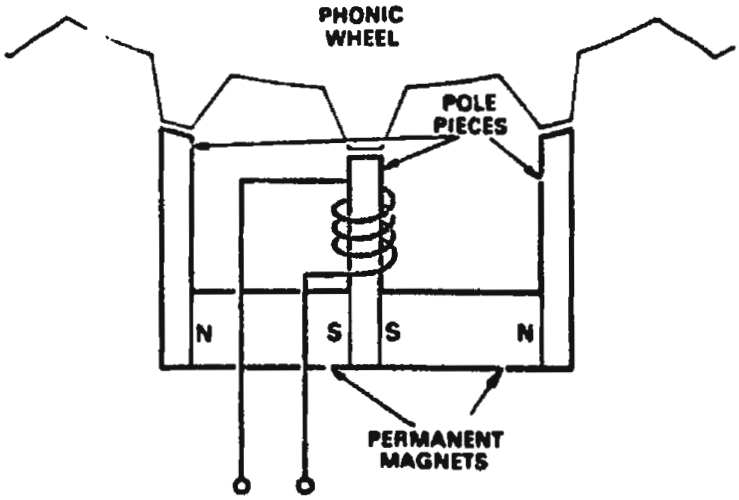
Lubrication of the generator bearings is provided by the engine oil system (Ref. 72-01-00) through the scalloped sections of the square drive.

As the HP compressor rotates, the generator is driven (via the high-speed external gearbox) and the rotor rotates within the stator coil to produce an electrical signal. The frequency is directly proportional to the speed of rotation of the rotor and, therefore, the HP compressor shaft.

4. LP (N1) Engine Shaft Speed Indicator

A. Description





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25039

Shaft Speed Pulse Probe and Diagram
Figure 5

The low-pressure (LP) engine shaft speed indicator (N1) provides the Captain and First Officer with vertical-tape (analog) indications of the operating speeds of the LP (fan) compressor modules of all three engines. The vertically mounted compound indicator contains three parallel-tape readout scales (Ref. Fig. 6).

The indicator consists of a bevel-edge case, a vertical scale plate, three amber maximum indication warning lights, three analog scale tapes, and three dc torquers. All indications are presented in percentage of maximum rated revolutions per minute (rpm), with 100 percent being equal to 3900 rpm shaft speed. The operating range markings on the faceplate on both sides of the tape scales are arranged for rapid identification in percent of rpm as follows:

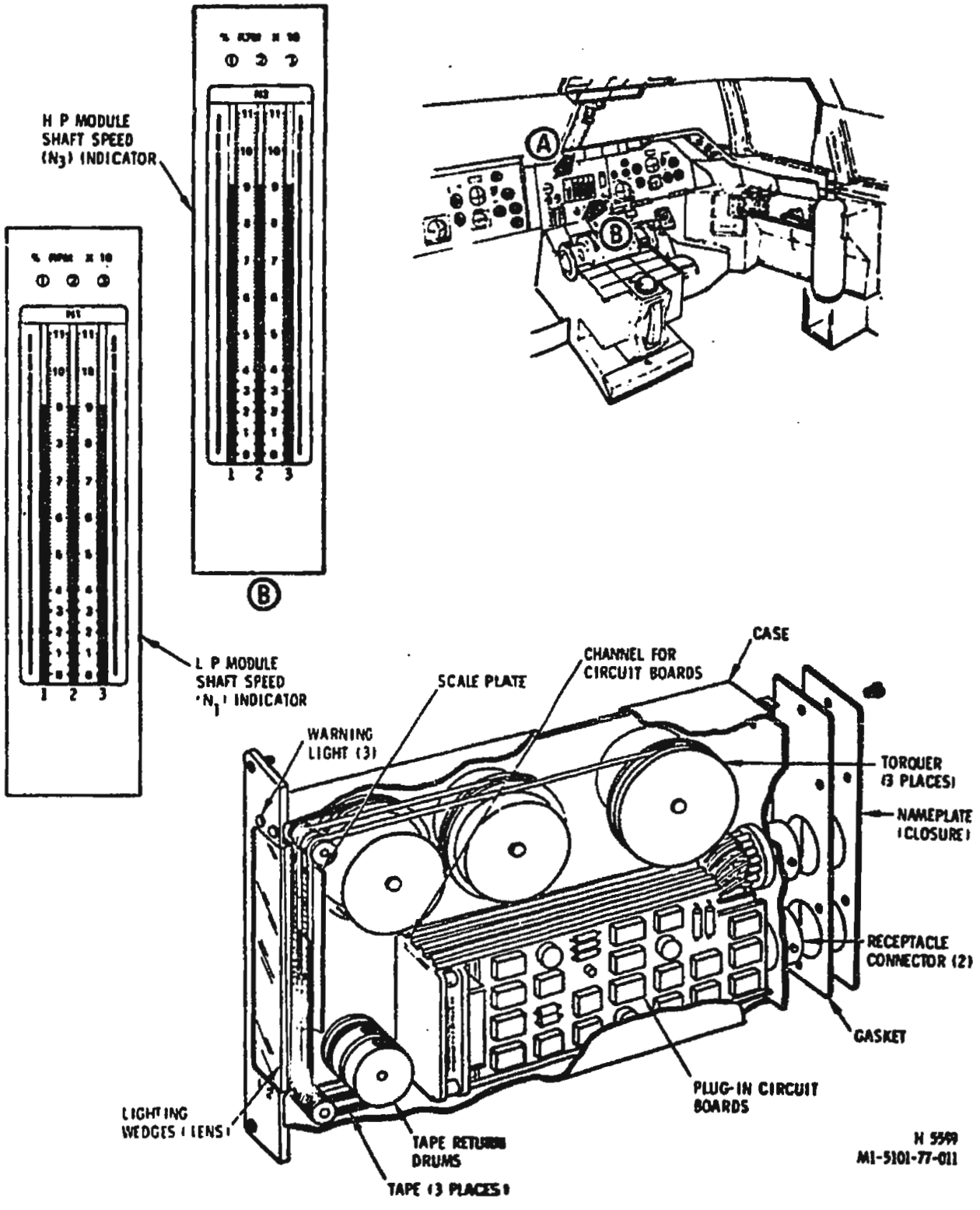
RANGE MARK	
Green Band	18 to 99.5
Yellow Band	99.5 to 101
Red Band	101 to 110

Three amber lights located above the tape scales provide a visual indication related to a specific engine whenever the overspeed warning system detects a shaft speed in excess of 101.5 (±.5). Whenever that rpm has been exceeded, a light will stay on until the speed declines to or below that speed. All signal-conditioning and tape-driving electronic components are contained in the indicator case. The plug-in printed circuit boards contain all electronic components, which are mounted on one side of each board.

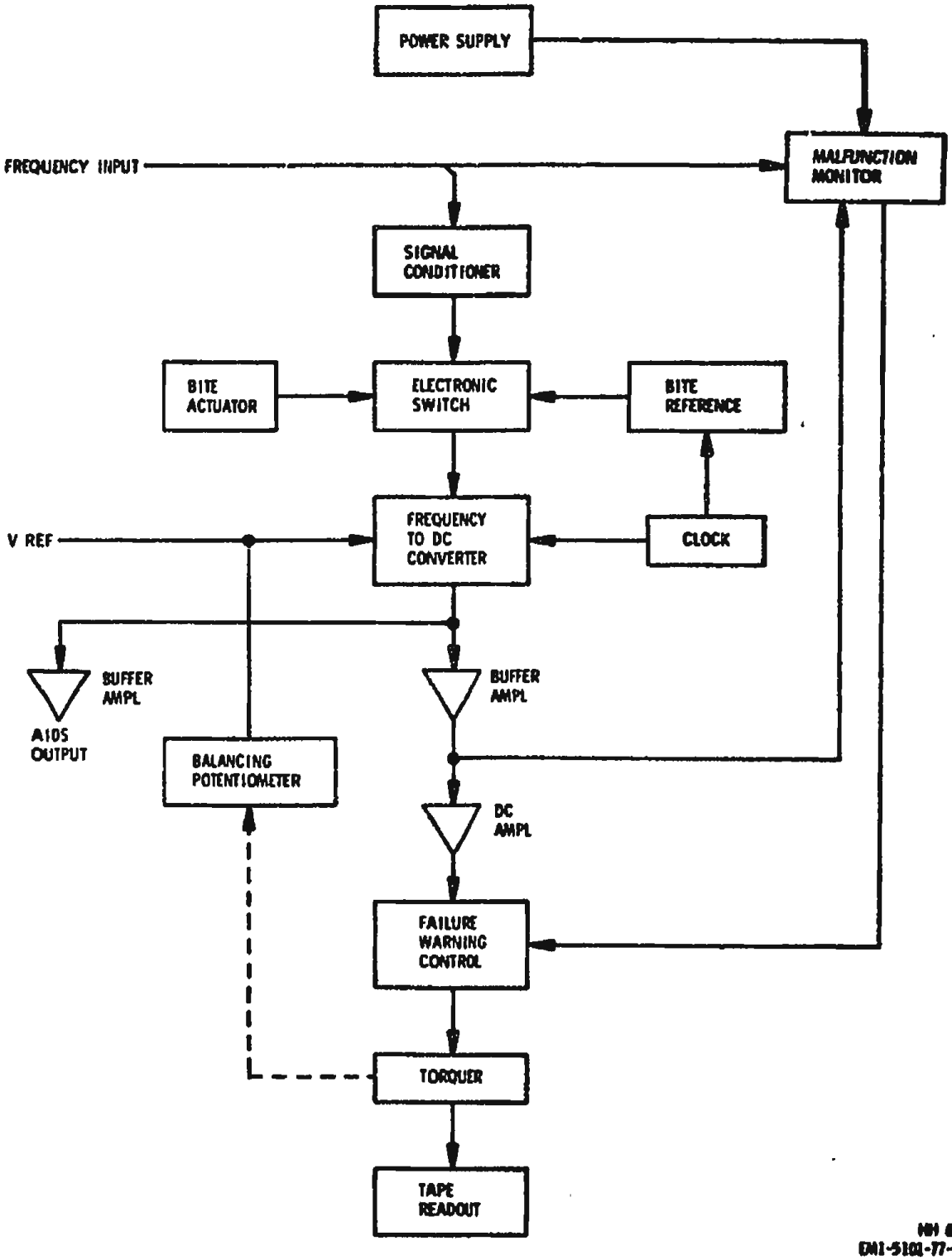
A dc torquer drives each woven-glass tape to provide the readouts. Tapes are attached to drums mounted on the torquer shafts. Two idlers guide each tape to the 1-inch-diameter, spring-loaded tension drums located at the other end of the tapes. The juncture of the white and black portions of each tape is the point at which the fixed indicating scale is read.

B. Operation

The N1 engine shaft speed indicator operates on 115V, 400-Hz power and uses 5V, 400-Hz power for illumination of the scales. The phonic wheel probe for the N1 compressor transmits a maximum input signal of 10V at 0 to 4290 Hz to operate the tape-driver electronics (Ref. Fig. 7).



LP (N1) and HP (N3) Engine Shaft Speed Indicators
Figure 6



LP (N1) Engine Shaft Speed Indicator Block Diagram
Figure 7

The dc-torquer field coils are energized from the amplifier output to provide plus or minus torque to balance the followup potentiometer. The dc output from the measurement circuit is compared to the potentiometer voltage. To stabilize the system, the potentiometer voltage rate of change is sensed, amplified, and applied to the torquer amplifier input circuit. The effect is to reduce the error signal into the torquer amplifier before null is reached. If the rate of change is high, the stabilizing voltage feedback could temporarily reverse torque before null is reached. Therefore, the motion slows soon enough to obtain fast response and avoid overshoot.

A signal conditioner is used to arrest noise and to convert the sensor signal to a usable level. The signal is converted to a dc voltage to drive the servo-actuated dc torquer. A crystal-controlled oscillator (clock) comprises the key element of the frequency-to-dc converter. Digital techniques are used to generate a constant-amplitude, constant-width pulse equal to one-half the clock period. The input frequency controls the repetitive rate of the pulse, while amplitude is controlled by an internal reference voltage and filtered to obtain the dc voltage. The voltage is dependent only on the duty cycle and, thereby, the input frequency.

A differential-input amplifier and a power output stage comprise the servoamplifier. Output of the frequency-to-voltage converter and the balance potentiometer constitute the two amplifier inputs. The difference between the voltages is the error which is amplified to drive the torquer, the tape, and the balance potentiometer. When the voltages are equal, there is no error signal and the black/white juncture of the tape has reached the measured N1 speed.

The torquer is designed to provide full tape travel with less than one revolution of the drum. The tension drum maintains light loading on the tape to keep it taut to prevent buckling which would result in readout errors. Spring tension is constant. Power failure in any channel will cause the tape to wind onto the tension drum until the black portion of the tape disappears below the zero mark (off scale). The white-on-red OFF warning will appear near the top of the scale plate.

The indicator system integrity monitoring functions are designed to check critical voltage levels. These functions will turn off the tape-drive torquers if the voltage levels fall below an established level. When an error signal exceeds a predetermined value for more than 10 seconds, a servo-positioning system malfunction is indicated. The

monitor function then interrupts torquer power, and the tape marker is pulled off-scale.

Provision is made in the indicator for connection to the aircraft integrated data system (AIDS) recorder.

5. IP (N2) Engine Shaft Speed Indicator

A. Description

The intermediate-pressure (IP) engine shaft speed indicator (N2) provides the Flight Engineer/Second Officer with analog (pointer) indications of the operating speed of the IP compressor module (Ref. Fig. 8).

The indicator is housed in a standard No. 2 ATI case. A dial plate, a pointer, a torquer, and plug-in printed circuit boards comprise the main elements of the indicator.

R On aircraft 001-031 without SB77-032,
R a resettable maximum indication pointer provides the means
R for permanently recording maximum revolutions per minute
R (rpm) in excess of 100.5 (+1, -0) percent attained during a
R flight.

R On aircraft 001-031 with SB77-032 and 032-999,
R a resettable maximum-indication pointer provides the means
R for permanently recording maximum revolutions per minute
R (RPM) in excess of 101.5 (+1, -0) percent attained during a
R flight.
R a resettable maximum indication pointer provides the means
R for permanently recording maximum revolutions per minute
R (rpm) in excess of 105 (+1, -0) percent attained during a
R flight.

No digital readout is provided by this indicator. Pointer indications are presented in percentage of maximum rated rpm, with 100 percent being equal to 7000 rpm shaft speed.

R On aircraft 001-031 without SB77-032, the dial plate is
R marked in percent rpm as follows:

Range Mark	
Green Band	35 to 101.5
Yellow Band	----

Range Mark	
Red Band	101.5

The maximum indication pointer normally rests at the 100.5 (+1, -0) position.

On aircraft 001-031 with SB77-032 and 032-999, the dial plate is marked in percent rpm as follows:

Range Mark	
Green Band	35 to 102.5
Yellow Band	----
Red Band	102.5

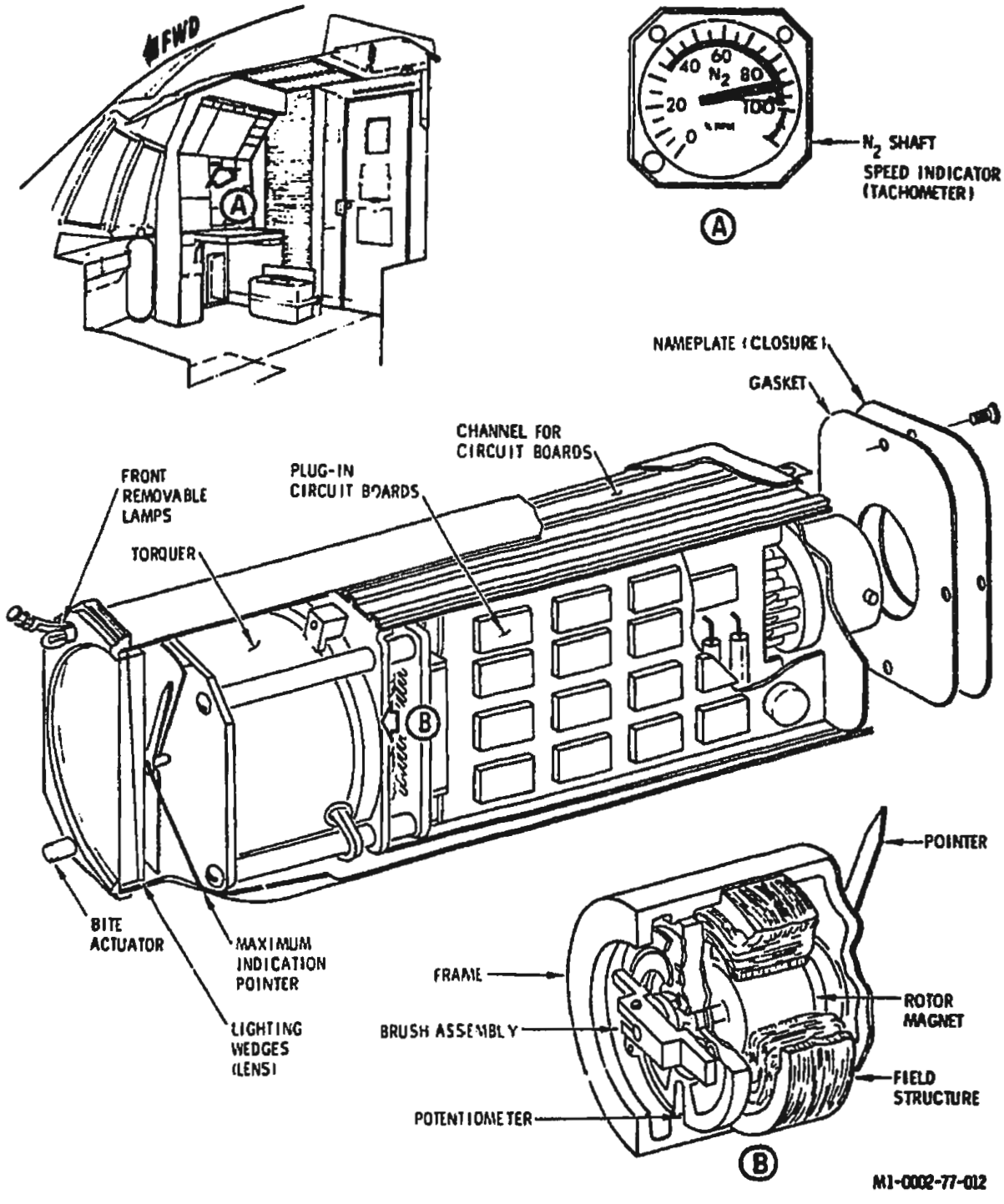
The maximum indication pointer normally rests at the 101.5 (+1, -0) position.

The indicator case houses all signal-conditioning and pointer-driving electronic components. These components are mounted only on one side of each replaceable plug-in circuit board. A dc torquer drives the main pointer. Two quickly replaceable, front-mounted lamps are combined with a wedge-type lens system for dial plate lighting. A built-in-test-equipment (BITE) actuator is located in the lower left corner on the front of the indicator.

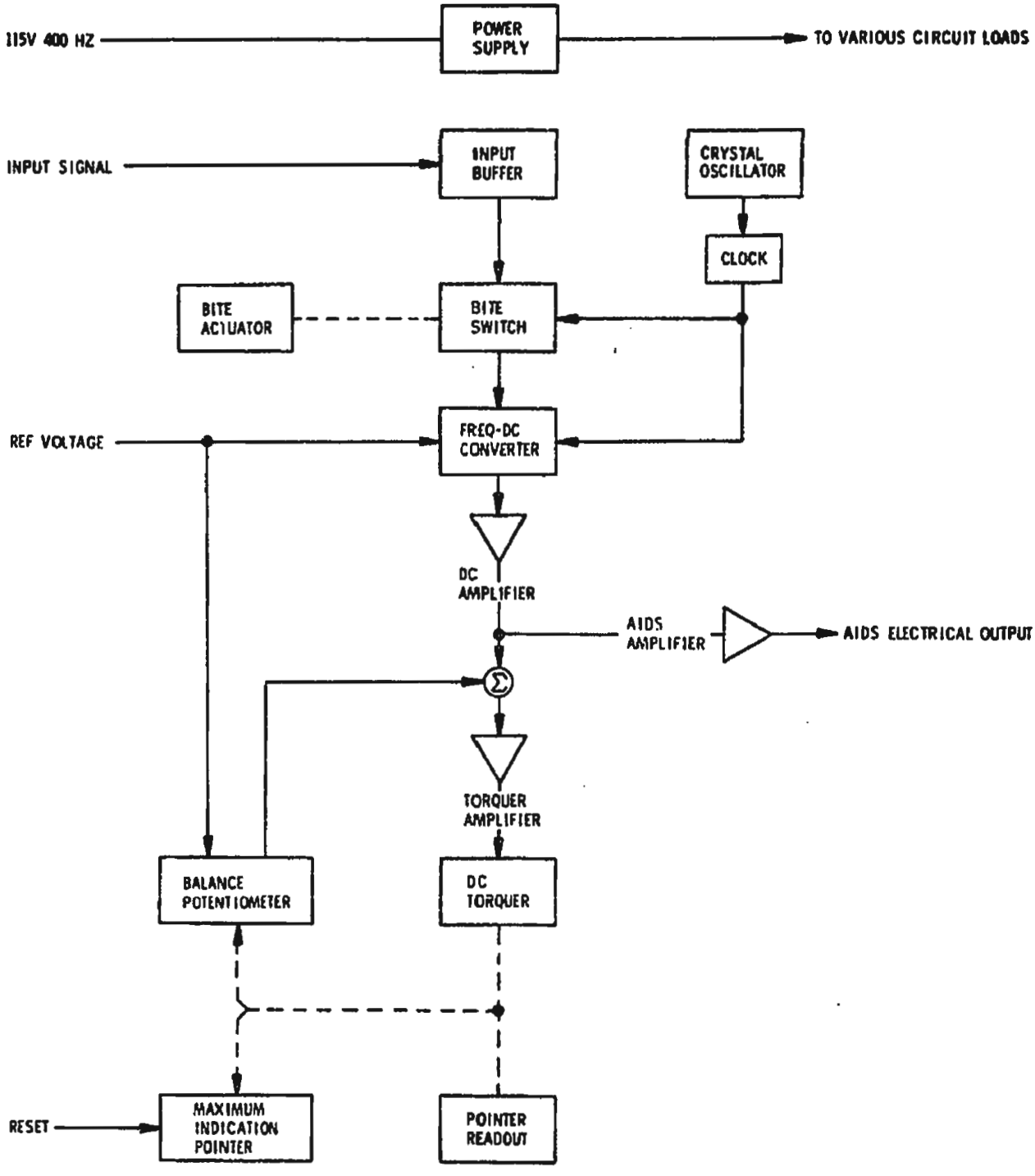
B. Operation

The engine shaft speed indicator operates on 115V, 400-Hz power. The pulse probe provides an input of 10V (maximum) ranging from 0 to 8400 Hz for operation of pointer electronics. The pointer is driven by a dc torquer. The readout results from the conversion of input frequency to a dc voltage to drive the servo-operated torquer (Ref. Fig. 9).

The servoamplifier uses a differential input amplifier and a power output stage. Signals issued by the balance potentiometer and the frequency-to-voltage converter provide the necessary inputs to the servoamplifier. The difference in the two dc voltages equals the error to be amplified for driving the torquer and balance potentiometer. As voltages equalize, no error signal is transmitted, and the pointer indicates the measured input speed.



R IP (N2) Engine Shaft Speed Indicator
R Figure 8



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IP (N2) Engine Shaft Speed Indicator Block Diagram
Figure 9

The BITE circuitry permits interrogation of indicator electronics when an indicator or system malfunction is suspected.

R On aircraft 001-031 without SB77-032,operation of the BITE
R switch will cause an internally generated frequency
R corresponding to a specific percentage of shaft speed rated
R rpm (approximately 60 percent or 5000 Hz) to drive the
R pointer to an approximately 12-o'clock position.

R On aircraft 001-031 with SB77-032 and 032-999,
R operation of the BITE switch will cause an internally
R generated frequency corresponding to a specific percentage
R of shaft speed rated rpm (approximately 91 percent or 7500
R Hz) to drive the pointer to an approximately 91% position.

Provision has been made for inclusion of aircraft integrated data system (AIDS) connection.

6. HP (N3) Engine Shaft Speed Indicator

A. Description

The high-pressure (HP) engine shaft speed indicator (N3) provides the Captain and First Officer with vertical-tape (analog) indications of the operating speeds of HP compressor modules in all three engines. The vertically mounted, compound indicator contains three parallel-moving tape readout scales (Ref. Fig. 6).

The multiscale indicator consists of a bevel-edge case, a faceplate, three amber maximum indicator warning lights, three analog scale tapes, and three dc torquers. A pair of inductive-load grounding switches for each engine (six per indicator) serve to cut off power to specific circuits at preset N3 shaft speed schedules.

All indications are presented in percentage of maximum rated revolutions per minute (rpm) with 100 percent being equal to 10,611 rpm shaft speed. Speed range marks on the faceplate on both sides of the tape scales are arranged for rapid identification in percent of rpm as follows:

Range Mark	
Green Band	50 to 93.7
Yellow Band	93.7 to 95
Red Band	95 to 110

An amber light is positioned above the tape scale for each engine. The light will come on whenever the HP shaft speed exceeds 95 (+1, -0) percent. The light will remain on until the speed declines to or below that speed.

All signal-conditioning and tape-driving electronic components are contained in the indicator case. All electronic components are mounted on one side of each of the replaceable plug-in printed circuit boards. A dc torquer drives each woven-glass tape to provide the analog readouts. Tapes are drum-mounted on the torquer shaft. Each tape is carried on a pair of idlers to a 1-inch-diameter, spring-loaded tension drum. The juncture of the white and black portions of the tape is the point at which the fixed indicating scale is read.

Two receptacle connectors are located on the closure end of the case. The 15-pin connector contains the aircraft integrated data system (AIDS) connections, while the other connector is wired for connection of a built-in-test-equipment (BITE) switch. All other input/output circuits are carried through the connectors.

B. Operation

The N3 engine shaft speed indicator operates on 115V, 400-Hz power and uses 5V, 400-Hz power for scale illumination. The tachometer generator supplies a maximum input of 18V at 0 to 462 Hz to operate the tape-drive electronics.

A frequency-to-dc converter uses digital techniques to generate a constant-amplitude, constant-width pulse for each cycle of the generator input frequency signal. Average voltage of the pulse train is then proportional to the input frequency. A stable, high-frequency clock signal is reduced by a digital integrated circuit frequency divider until it is between 3 and 5 times the maximum signal frequency. Both frequencies are applied to a simple logic circuit which gates one cycle of the low clock frequency onto the output line for each cycle of the input signal.

A solid-state switch is used to form the output of the logic circuit into a pulse train which is integrated by a simple RC filter and buffered by an integrated circuit voltage follower before reaching the servo-null amplifier. The dc voltage at the follower is proportional to the duty cycle of the pulse train and the frequency of the input signal.

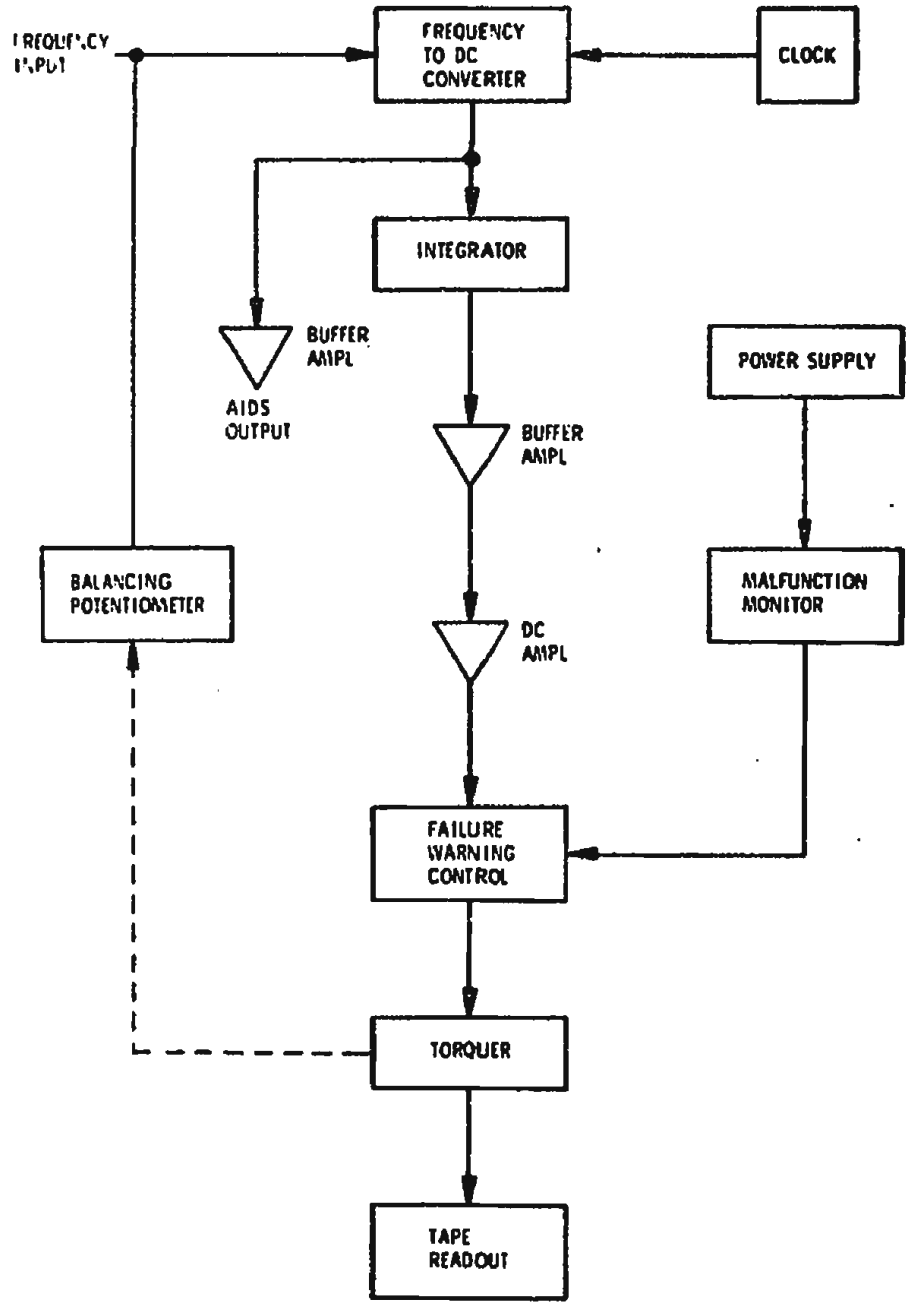
A differential input operational amplifier and a power output stage comprise the servoamplifier. Output of the frequency-to-voltage converter and the balance potentiometer constitute the two amplifier inputs. The difference in the

two dc voltages is the error which, when amplified, drives the torquer, the tape, and the balance potentiometer. Whenever the voltage differential is zero, no error signal exists; therefore, the torquer stops and the tape marking indicates the actual shaft speed.

The torquer is designed so that full tape travel is obtained with less than one revolution of the drum. Torquer field coils are energized from the output of the amplifier, to provide plus or minus torque, as required, to balance the followup potentiometer. The potentiometer voltage is compared to the 0 to 5V dc output from the measurement circuit. A stabilizing voltage feedback circuit is used to avoid tape overshoot in case of a high rate of change in rpm. Light tension is applied to the tape at the takeup drum to keep it taut and to avoid any readout error due to tape distortion. The spring tension is constant. In the event of a power failure in any channel, the spring will draw the tape onto the drum until the black portion of the tape disappears off scale below the zero mark. The white-on-red OFF warning will appear near the top of the scale plate.

The indicator system integrity monitoring functions are designed to monitor critical voltage levels and to turn off the tape drive torquers if the voltage levels fall below an established level. If an error signal exceeds a predetermined value for more than 10 seconds, it is indicative of a servo-positioning system malfunction. The monitor then interrupts torquer power, and the tape is pulled off scale (Ref. Fig. 10).

Two 28V.dc, inductive-load grounding switches in the indicator operate at preset rotational speeds to affect the starting circuit and the emergency hydraulic supply system. One switch is set to operate at 43 to 46 percent rpm (4580 to 4880 rpm). Switch actuation results in termination of ignition and the start of fuel jet operation. Switch actuation also commands closing of the starter control valve to prevent overspeed of the starter following engine light-off, which occurs at approximately 23 percent of rated rpm. The other switch operates at 50.8 to 51.7 percent rpm (5400 to 5500 rpm) to deploy the ram air turbine.



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HP (N3) Engine Shaft Speed Indicator Block Diagram
Figure 10

R ENGINE SHAFT SPEED INDICATING SYSTEM - FAULT ISOLATION

R 1. General

R The fault isolation diagrams in this section can be used for fault isolation any time a fault is reported or suspected. Before fault isolation is started, the PREREQUISITES listed on the diagram must be fulfilled.

R If the flight crew reports a trouble using a FIRM Fault Code number, the number can be found in the FIRM Fault Code Cross Reference Table in the Chapter 77-INDEX.

R The FIRM Fault Code Cross Reference Table includes the flight report (fault symptoms) and the exact Section, Figure, Sheet, and Block number where fault isolation should begin. (Refer to the L-1011 Maintenance Manual Introduction for a more detailed explanation on the use of fault isolation diagrams.)

R If a fault is reported or suspected and no FIRM Fault Code is available, the function or fault indication can be found in the table below. When a diagram is selected in this manner fault isolation is started at Block 1.

R NOTE: When N2 overspeed indication is encountered and other indications/conditions contradict probability of overspeed, check the resistor in the signal lead within 12 inches of the indicator for proper value and security. If replacement is necessary use a carbon or film (not wire wound) type resistor.

R 2. Fault Isolation/Identification

R Table 101 is a list of all fault isolation data in this section of the manual.

R Engine Shaft Speed Indication System Fault Isolation
R Table 101

FIGURE	TITLE
101	Component Location Index
102	Component Locator
103	N1 and N3 Shaft Speed Indication Fault Isolation
104	N2 Shaft Speed Indication Fault Isolation

R Engine Shaft Speed Indication System Fault Isolation (Cont)
R Table 101

FIGURE	TITLE
SCHEM 1	LP Shaft Speed Indicating Circuits
SCHEM 2	IP Shaft Speed Indicating Circuits
SCHEM 3	HP Shaft Speed Indicating Circuits

COMPONENT	QTY	AREA/ACCESS	REFERENCE
N1 SHAFT SPEED INDICATOR	1	FLT STATION/PILOTS CENTER INST PANEL	77-12-05
N2 SHAFT SPEED INDICATOR	3	FLT STATION/ENGINE STATUS PANEL	77-12-06
N3 SHAFT SPEED INDICATOR	1	FLT STATION/PILOTS CENTER INST PANEL	77-12-08
HP TACHOMETER GENERATOR			
WING ENGINES	2	ACCESSORY SECTION/LH HINGED COWL	
NO. 2 ENGINE	1	ACCESSORY SECTION/LOWER LH HINGED COWL	77-12-03

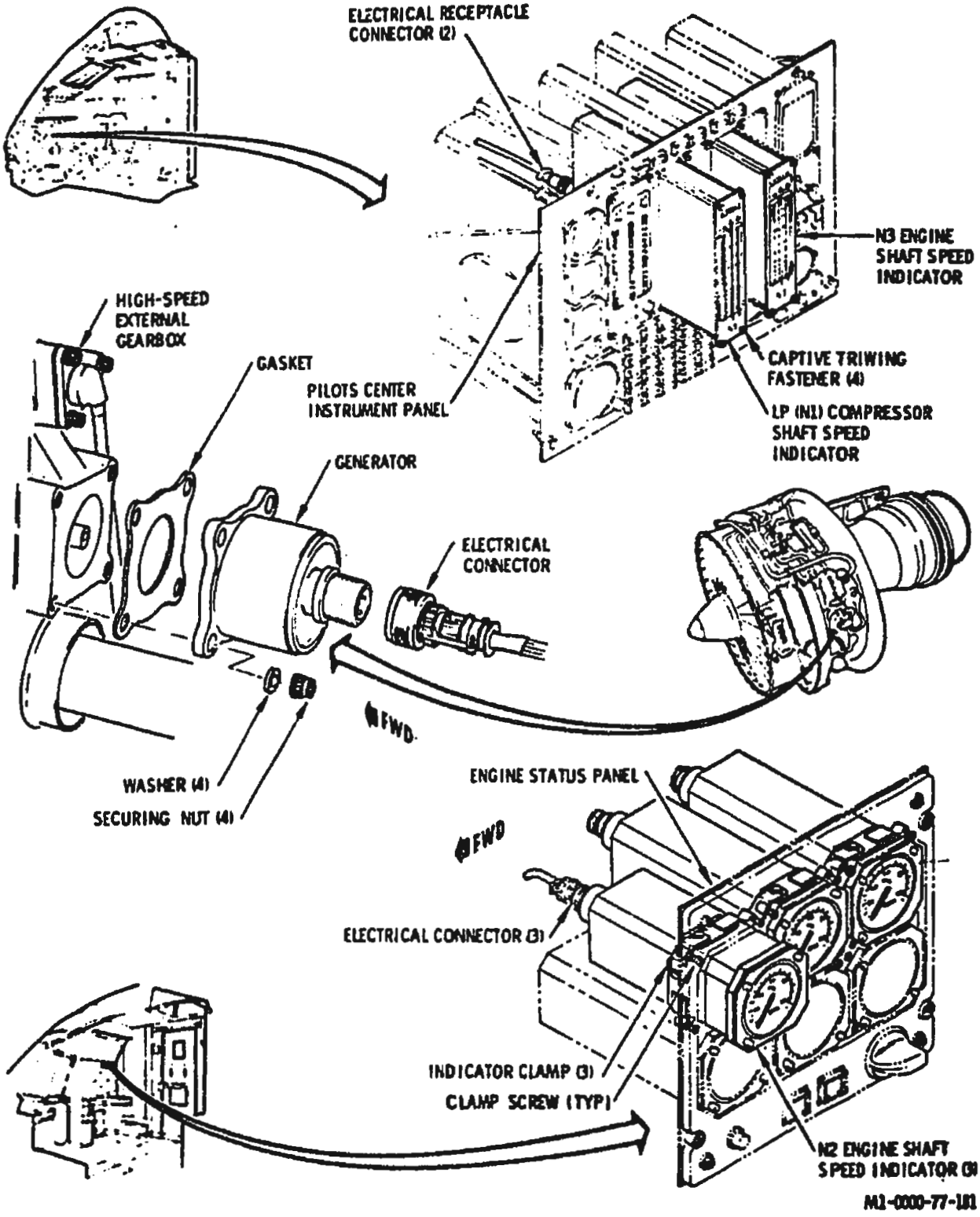
M1-0000-77-176

Component Location Index
Figure 101

R
R

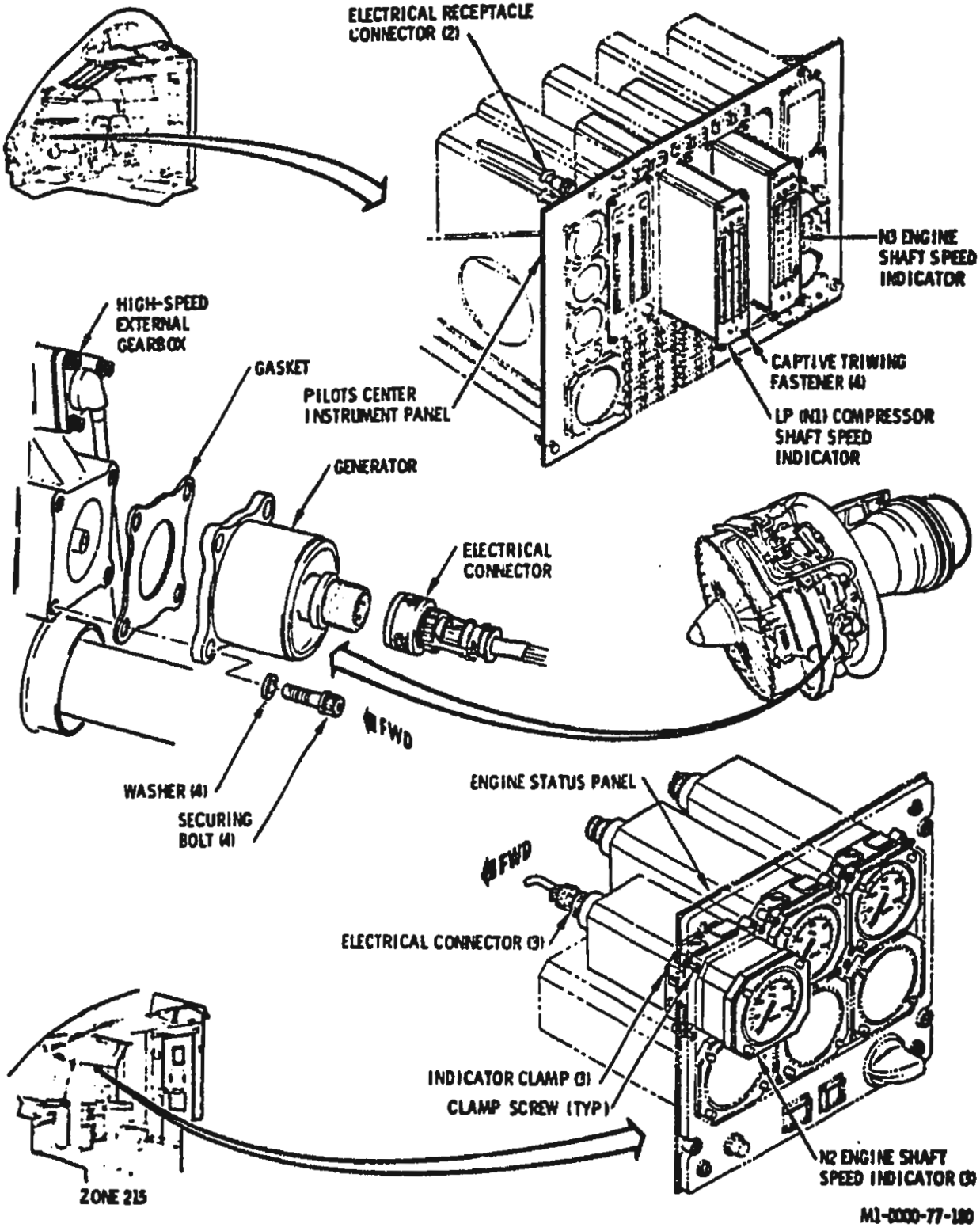
R EFFECTIVITY: ALL
R
R

001B



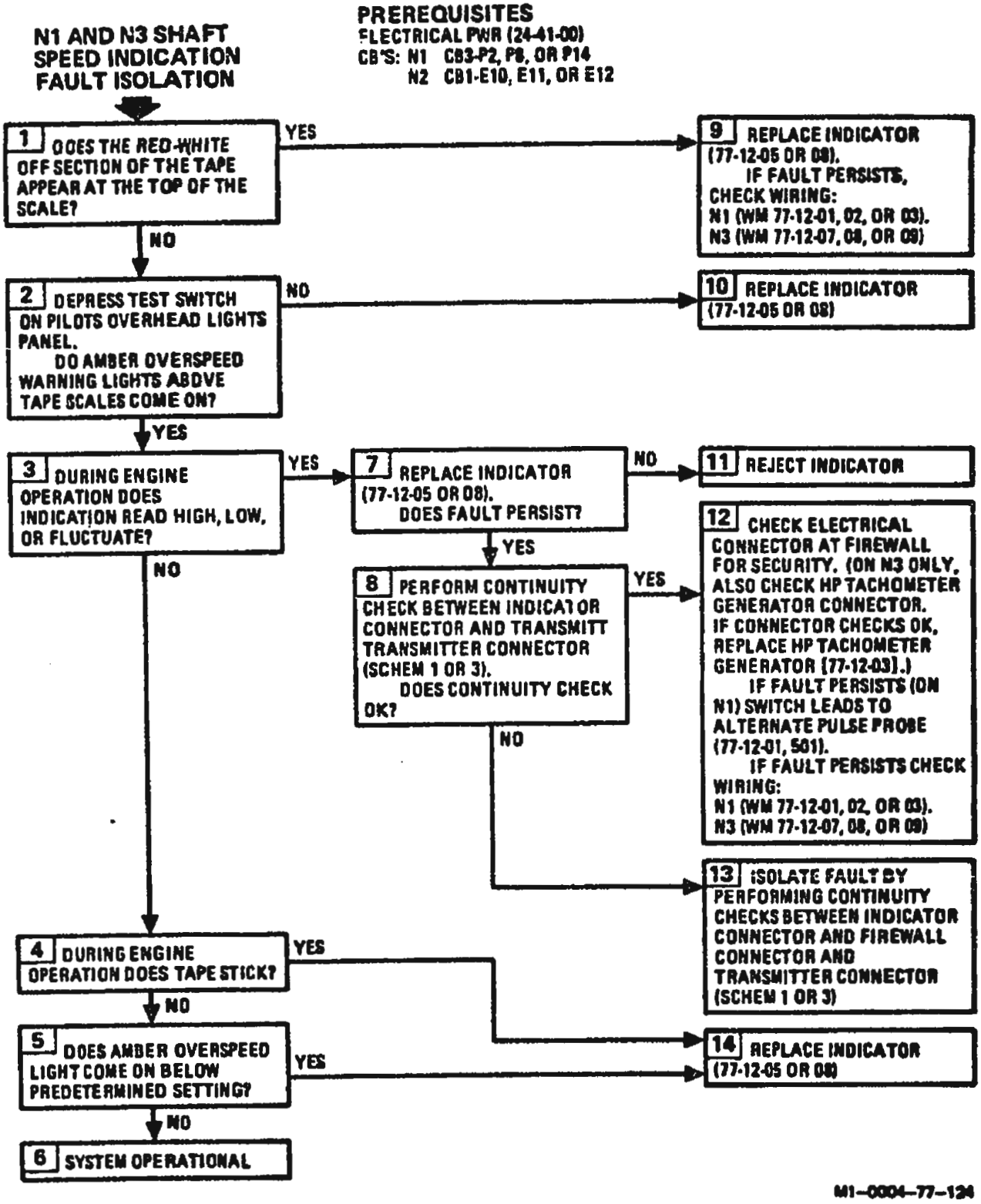
R R Component Locator
Figure 102

R R 001B EFFECTIVITY: 001-031 WITHOUT RR SB72-2073



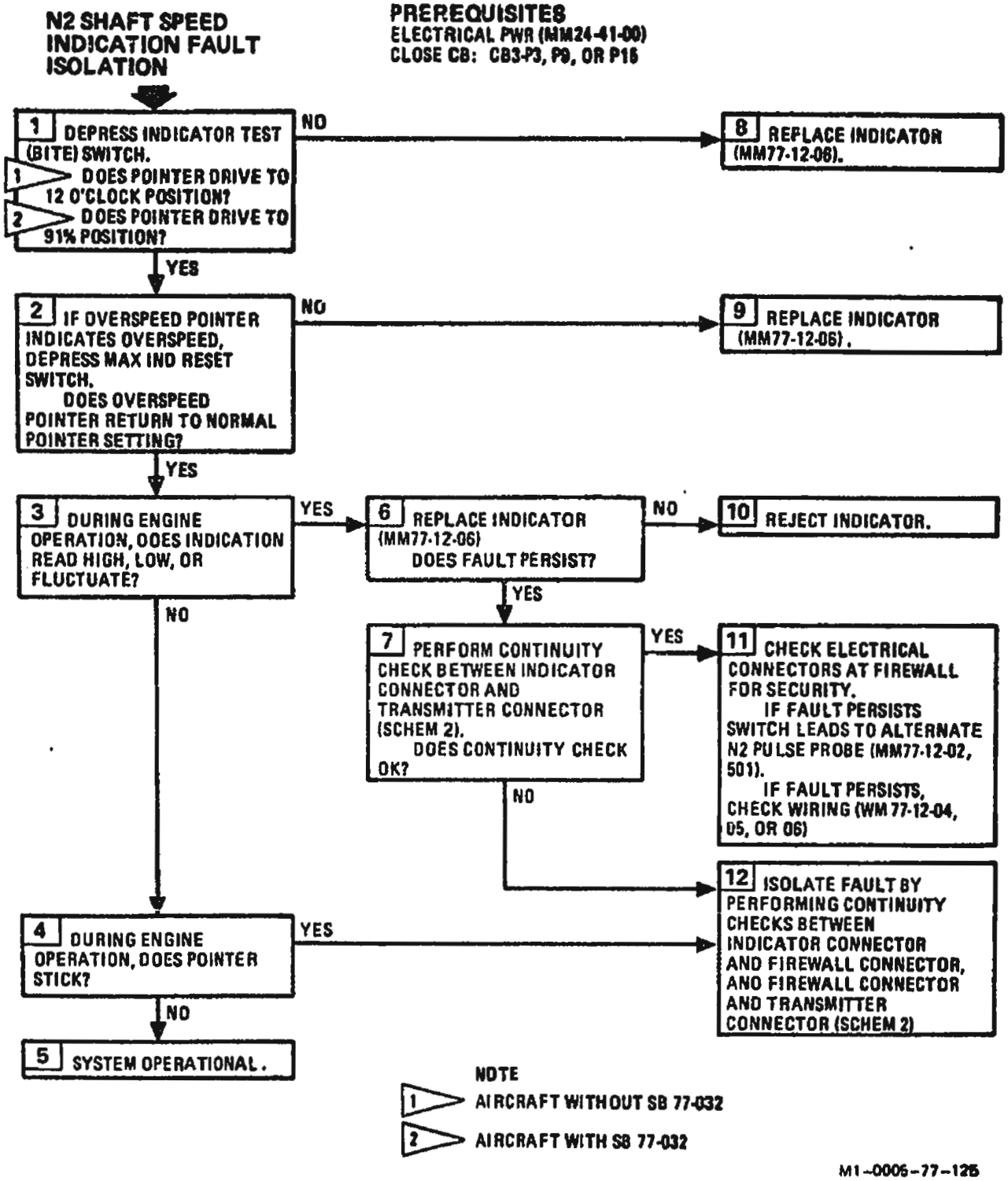
Component Locator
Figure 102

EFFECTIVITY: 001-031 WITH RR SB72-2073 AND 032-999

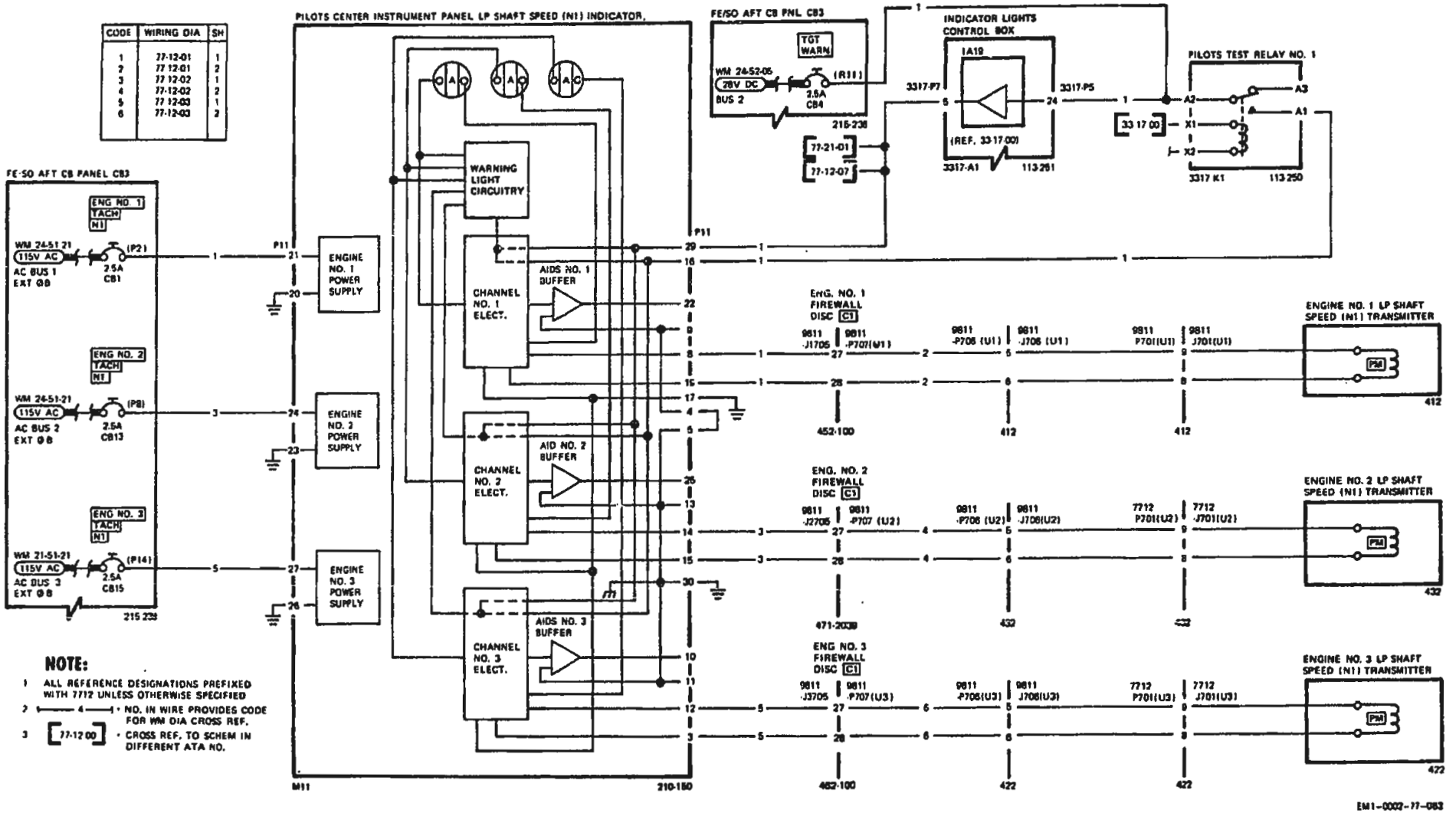

N1 AND N3 SHAFT SPEED INDICATION FAULT ISOLATION
PREREQUISITES
ELECTRICAL PWR (24-41-00)
CB'S: N1 CB3-P2, P8, OR P14
N2 CB1-E10, E11, OR E12
1 DOES THE RED-WHITE OFF SECTION OF THE TAPE APPEAR AT THE TOP OF THE SCALE?
YES
9 REPLACE INDICATOR (77-12-05 OR 08). IF FAULT PERSISTS, CHECK WIRING: N1 (WM 77-12-01, 02, OR 03). N3 (WM 77-12-07, 08, OR 09)
NO
2 DEPRESS TEST SWITCH ON PILOTS OVERHEAD LIGHTS PANEL. DO AMBER OVERSPEED WARNING LIGHTS ABOVE TAPE SCALES COME ON?
NO
10 REPLACE INDICATOR (77-12-05 OR 08)
YES
3 DURING ENGINE OPERATION DOES INDICATION READ HIGH, LOW, OR FLUCTUATE?
YES
7 REPLACE INDICATOR (77-12-05 OR 08). DOES FAULT PERSIST?
NO
11 REJECT INDICATOR
YES
8 PERFORM CONTINUITY CHECK BETWEEN INDICATOR CONNECTOR AND TRANSMITT TRANSMITTER CONNECTOR (SCHEM 1 OR 3). DOES CONTINUITY CHECK OK?
YES
12 CHECK ELECTRICAL CONNECTOR AT FIREWALL FOR SECURITY. (ON N3 ONLY, ALSO CHECK HP TACHOMETER GENERATOR CONNECTOR. IF CONNECTOR CHECKS OK, REPLACE HP TACHOMETER GENERATOR (77-12-03).) IF FAULT PERSISTS (ON N1) SWITCH LEADS TO ALTERNATE PULSE PROBE (77-12-01, 501). IF FAULT PERSISTS CHECK WIRING: N1 (WM 77-12-01, 02, OR 03). N3 (WM 77-12-07, 08, OR 09)
NO
13 ISOLATE FAULT BY PERFORMING CONTINUITY CHECKS BETWEEN INDICATOR CONNECTOR AND FIREWALL CONNECTOR AND TRANSMITTER CONNECTOR (SCHEM 1 OR 3)
NO
4 DURING ENGINE OPERATION DOES TAPE STICK?
YES
14 REPLACE INDICATOR (77-12-05 OR 08)
NO
5 DOES AMBER OVERSPEED LIGHT COME ON BELOW PREDETERMINED SETTING?
YES
NO
6 SYSTEM OPERATIONAL
M1-0004-77-124

R N1 and N3 Shaft Speed Indicating Fault Isolation
R Figure 103

R EFFECTIVITY: ALL


N2 SHAFT SPEED INDICATION FAULT ISOLATION
PREREQUISITES
ELECTRICAL PWR (MM24-41-00)
CLOSE CB: CB3-P3, P9, OR P15
1 DEPRESS INDICATOR TEST (BITE) SWITCH.
1 DOES POINTER DRIVE TO 12 O'CLOCK POSITION?
2 DOES POINTER DRIVE TO 91% POSITION?
NO
8 REPLACE INDICATOR (MM77-12-06).
YES
2 IF OVERSPEED POINTER INDICATES OVERSPEED, DEPRESS MAX IND RESET SWITCH.
DOES OVERSPEED POINTER RETURN TO NORMAL POINTER SETTING?
NO
9 REPLACE INDICATOR (MM77-12-06).
YES
3 DURING ENGINE OPERATION, DOES INDICATION READ HIGH, LOW, OR FLUCTUATE?
YES
6 REPLACE INDICATOR (MM77-12-06)
DOES FAULT PERSIST?
NO
10 REJECT INDICATOR.
YES
7 PERFORM CONTINUITY CHECK BETWEEN INDICATOR CONNECTOR AND TRANSMITTER CONNECTOR (SCHEM 2).
DOES CONTINUITY CHECK OK?
YES
11 CHECK ELECTRICAL CONNECTORS AT FIREWALL FOR SECURITY.
IF FAULT PERSISTS SWITCH LEADS TO ALTERNATE N2 PULSE PROBE (MM77-12-02, 501).
IF FAULT PERSISTS, CHECK WIRING (WM 77-12-04, 05, OR 06)
NO
12 ISOLATE FAULT BY PERFORMING CONTINUITY CHECKS BETWEEN INDICATOR CONNECTOR AND FIREWALL CONNECTOR, AND FIREWALL CONNECTOR AND TRANSMITTER CONNECTOR (SCHEM 2)
NO
4 DURING ENGINE OPERATION, DOES POINTER STICK?
YES
NO
5 SYSTEM OPERATIONAL.
NOTE
1 AIRCRAFT WITHOUT SB 77-032
2 AIRCRAFT WITH SB 77-032
M1-0005-77-125

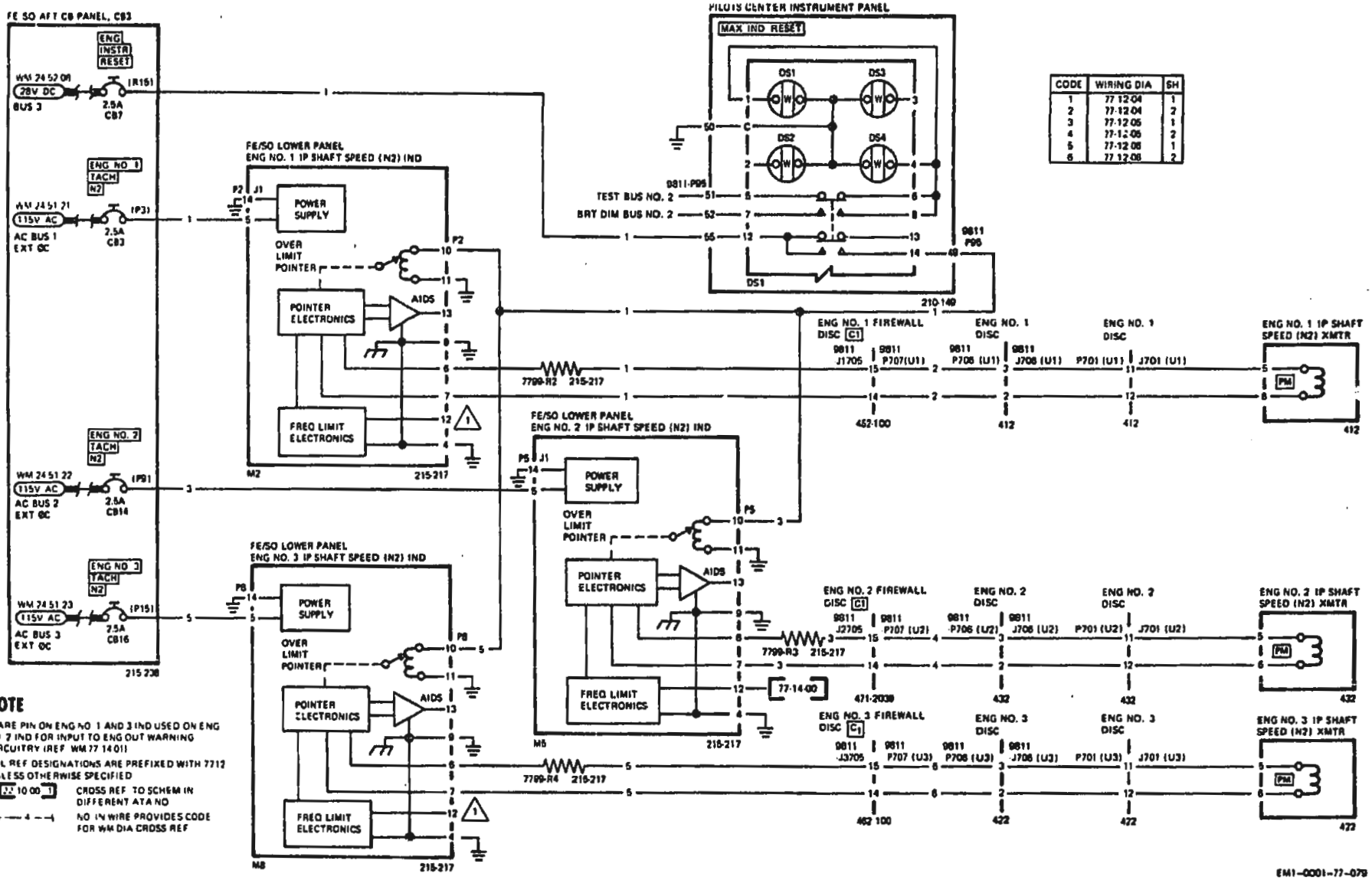
R N2 Shaft Speed Indication Fault Isolation
R Figure 104



R
R LP Shaft Speed Indicating Circuits
SCHEM 1

EFFECTIVITY: ALL

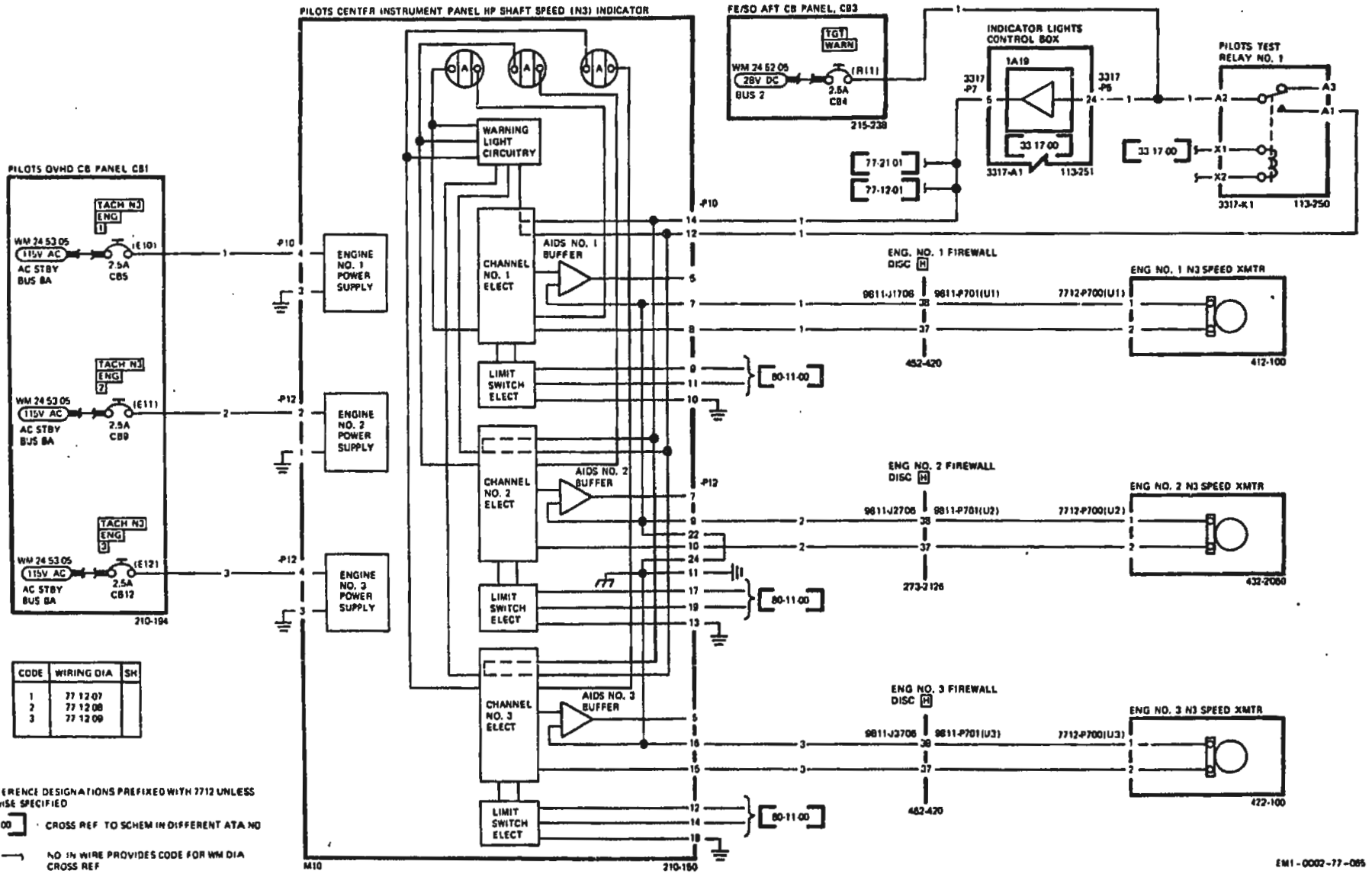
0018



R R IP Shaft Speed Indicating Circuits
SCHEM 2

EFFECTIVITY: ALL

001B



R HP Shaft Speed Indicating Circuits
R SCHEM 3

EFFECTIVITY: ALL

001B

LOW-PRESSURE (N1) SHAFT SPEED PULSE PROBE - ADJUSTMENT AND TEST

1. General

In the event of failure of the main N1 pulse probe the following procedure can be adopted to connect the alternative pulse probe to the N1 indicating system.

2. Equipment and Materials

CR Insertion/Extraction Tool, (Refer to E&E Manual Chapter 20)

3. Referenced Procedures

71-00-00 Power Plant - Adjustment and Test

71-11-00 Engines No. 1 and 3 Cowling, - Servicing

71-12-05 LH and RH Upper Hinged Cowl - Servicing

4. Adjustment/Test

A. Adjust Alternate N1 Pulse Probe

(1) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag applicable circuit breaker ENG NO. TACH N1 (P2, P8, or P14).

(2) Open LH hinged cowl 413A or 423A for engine No. 1 or 3 (Ref. 71-11-00), or upper LH hinged cowl 433DL for engine No. 2 (Ref. 71-12-05).

(3) Locate module terminals identified as 7C, 9D, 8C, 9C, 8D, and 7D (Ref. Fig. 501).

NOTE: The terminal contacts are tagged with the module terminal identification to which they were connected on engine build. They may however have been changed over therefore the module terminals should be used for identification during the following operations.

(4) Using insertion/extraction tool, change over terminal contacts in terminals 7C and 9D.

(5) Using insertion/extraction tool, change over terminal contacts in terminals 8C and 9C.

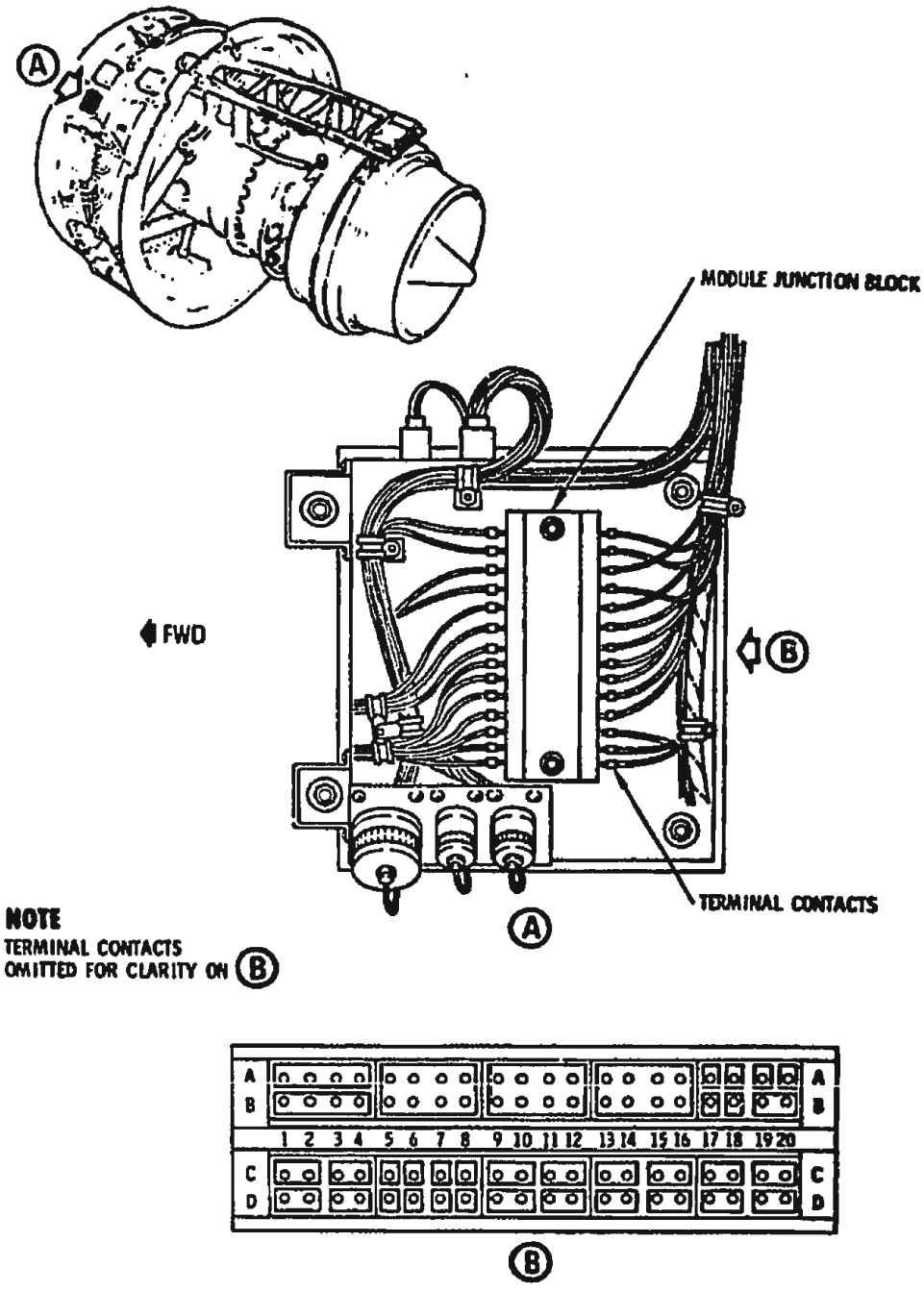
(6) Using insertion/extraction tool, change over terminal contacts in terminals 8D and 7D.

(7) Close cowl (Ref. 71-11-00 or 71-12-00).

(8) Remove tag and close circuit breaker opened in Step 4A(1).

B. Test Alternate N1 Pulse Probe

(1) Motor engine (Ref. 71-00-00) and observe applicable N1 shaft speed indicator, zone 210, for indication of engine shaft rotation.



Shaft Speed Pulse Probe - Adjustment and Test
Figure 501

INTERMEDIATE PRESSURE (IP) SHAFT SPEED (N2) PULSE PROBE ADJUSTMENT AND TEST

1. General

In the event of failure of the main N2 pulse probe the following procedure can be adopted to connect the alternative pulse probe to the N2 indicating system.

2. Equipment and Materials

CR Insertion/Extraction Tool, (Refer to E&E Manual, Chapter 20)

3. Referenced Procedures

71-00-00 Power Plant - Adjustment and Test

71-11-00 Engines No. 1 and No. 3 Cowling - Servicing

71-12-05 LH and RH Upper Hinged Cowls - Servicing

4. Adjustment/Test

A. Adjust Alternate N2 Pulse Probe

(1) On Flight Engineer/Second Officers aft circuit breaker panel, zone 215, open and tag applicable circuit breaker ENG NO. TACH N2 (P3, P9 or P15).

(2) Open LH hinged cowl 413A or 423A for engine No. 1 or 3 (Ref. 71-11-00), or LH upper hinged cowl 433DL for engine No. 2 (Ref. 71-12-05).

(3) Locate module terminals identified as 5C, 11C, 6C, 11D, 6D and 13D (Ref. Fig. 501).

NOTE: The terminal contacts are tagged with the module terminal identification to which they were connected on engine build. They may however have been changed over therefore the module terminals should be used for identification during the following operations.

(4) Using insertion/extraction tool, change over terminal contacts in terminals 5C and 11C.

(5) Using insertion/extraction tool, change over terminal contacts in terminals 6C and 11D.

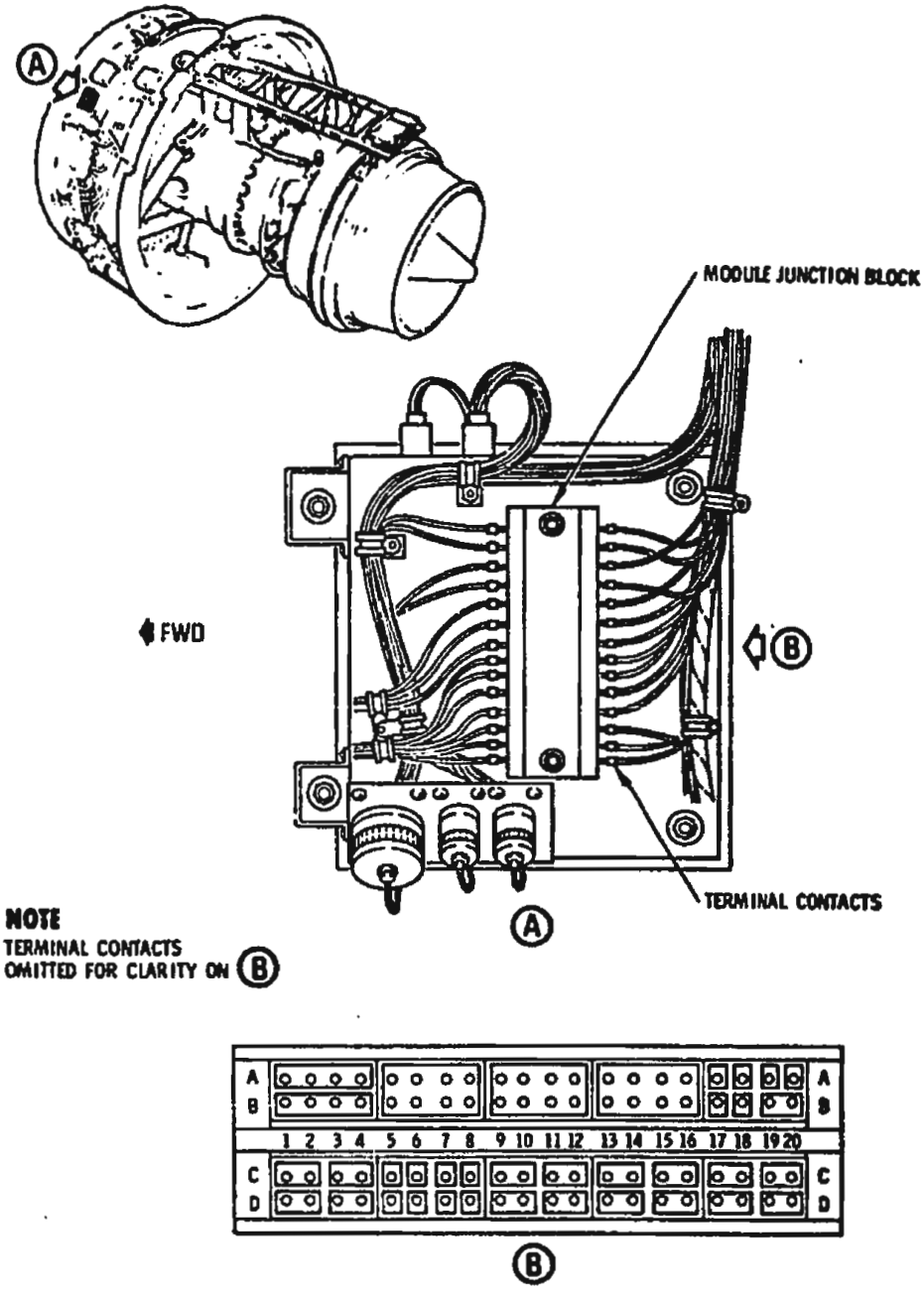
(6) Using insertion/extraction tool, change over terminal contacts in terminals 6D and 13D.

(7) Close cowl (Ref. 71-11-00 or 71-12-05).

(8) Remove tag and close circuit breaker opened in Step 4A(1).

B. Test Alternate N2 Pulse Probe

(1) Motor the engine (Ref. 71-00-00) and observe applicable N2 indicator, zone 215, for indication of engine shaft rotation.



M1-0102-77-501

Alternate N2 Pulse Probe
Figure 501

HIGH-PRESSURE (N3) TACHOMETER GENERATOR REMOVAL AND INSTALLATION

1. Equipment and Materials

Joint Compound, British Spec DTD.900/4586, or equivalent

Degreasing Fluid, British Spec B.S.4487:1969, or equivalent

Trichloroethane, Fed Spec O-T-620, or equivalent

Protective gloves

Stiff-bristle brush

Blanking plate

Clean white rag

2. Referenced Procedures

71-11-00	Engines No. 1 and No. 3 Cowling - Servicing
71-12-01	LH and RH Lower Hinged Cowl - Servicing
72-01-00	Oil System - Removal/Installation
72-01-00	Oil System - Inspection/Check

3. Removal/Installation

A. Removal

(1) On the pilots overhead circuit breaker panel CB1, zone 210, open and tag the applicable circuit breaker ENGINE TACH N3 ENG 1, 2, or 3 (E10,E11, or E12).

(2) Open LH hinged cowl 413A or 414A for engines No. 1 and 3 (Ref. 71-11-00) or 433 AL for engine No. 2 (Ref. 71-12-01).

R (3) Locate tachometer generator on aft face of high-speed external gearbox, next to fuel flow regulator, and disconnect electrical connector (Ref. Fig. 401).

(4) Remove nuts and washers, and remove tachometer generator and gasket; discard gasket.

NOTE: On engines incorporating SB72-2073 (High speed - Retention of HP tachometer generator by bolts), remove bolts and washers, and remove tachometer generator and gasket; discard gasket.

(5) If new generator is not to be installed immediately, install approved blanking plate on tachometer generator mounting pad.

(6) Remove and inspect then install external gearbox magnetic chip detector (Ref. 72-01-00).

B. Installation

(1) Verify that circuit breaker opened in Step 3A(1) is open and tagged.

WARNING: PROTECTIVE GLOVES MUST BE WORN WHEN USING DEGREASING FLUID.

(2) Moisten rag with degreasing fluid (or trichloroethane) and remove all traces of old jointing compound from mating face of mounting pad.

R (3) Using stiff-bristle brush, apply thin coating of jointing compound to mating faces of mounting pad and tachometer generator (Ref. Fig. 401). Allow a minimum drying time of 10 minutes.

(4) Install new gasket and generator on mounting pad. Secure with washers and nuts.

NOTE: On engines incorporating SB 72-2073, install new gasket and generator on mounting pad. Secure with washers and bolts.

CAUTION: ENSURE ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

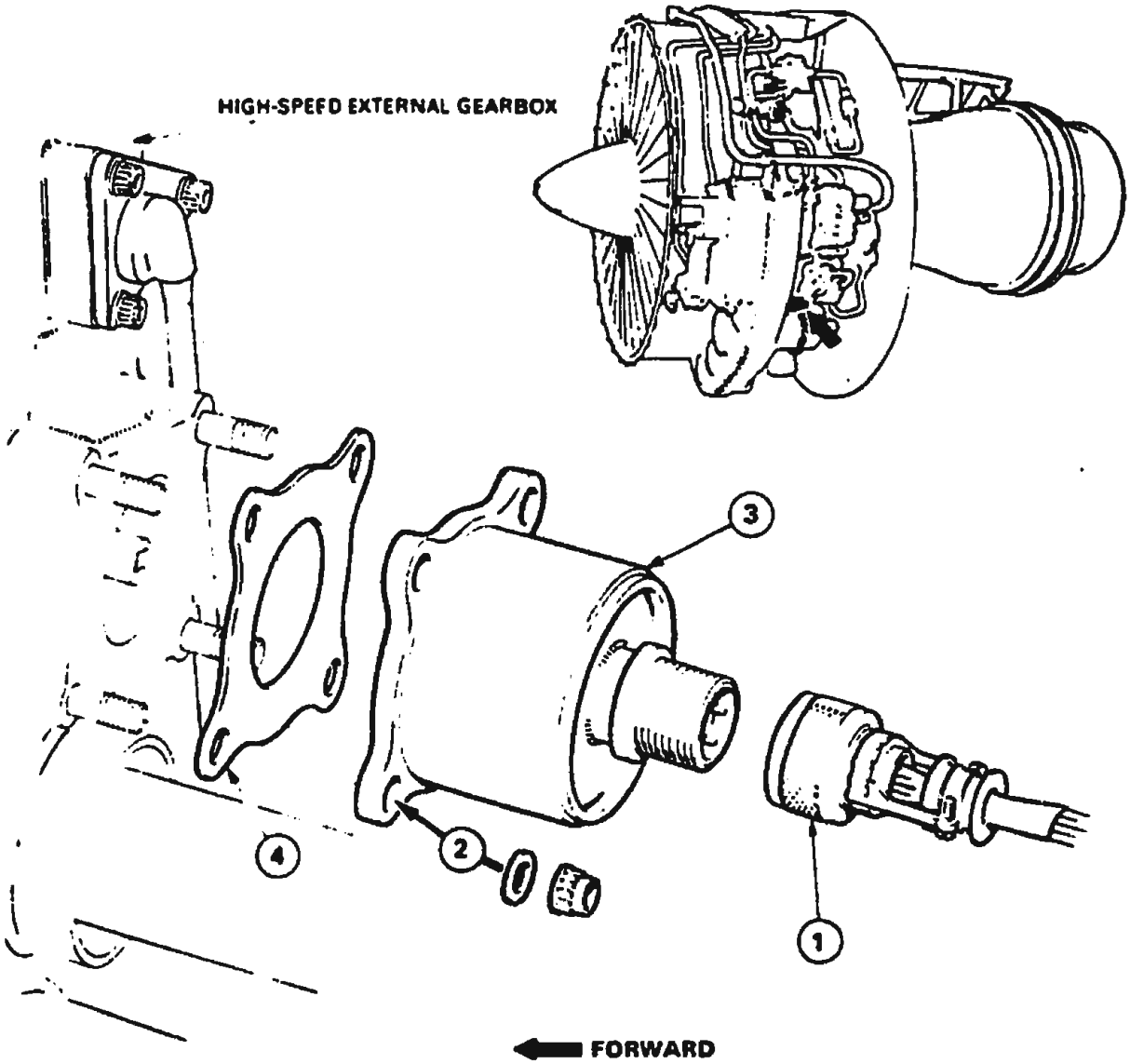
(5) Connect electrical connector.

(6) Remove tag and close circuit breaker opened in Step 3A(1).

(7) Close cowl (Ref. 71-11-00 or 71-12-01).

R (8) During next engine motoring or runup procedure, observe applicable N3 shaft speed indicator, zone 210, to verify tachometer generator operation.

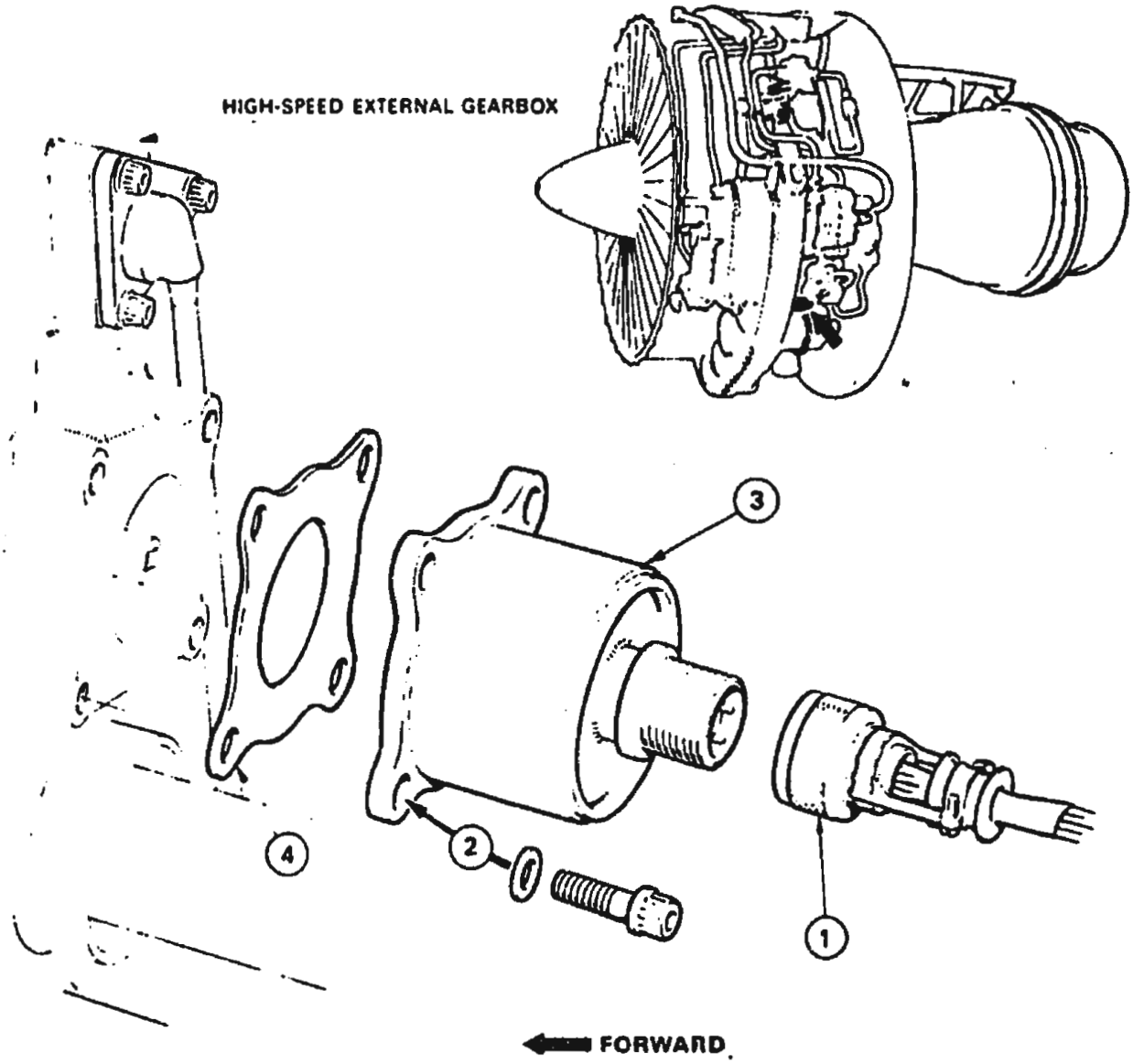
(9) Following shutdown after engine runup, inspect generator installation to verify that no leaks exist.



1. Electrical connector
2. Securing nut and washer (4 off)
3. Generator
4. Gasket

HA 0100
M1-0101-77-400
26000A

HP Tachometer Generator - Removal and Installation
Figure 401



1. Electrical connector
2. Securing bolt and washer (4 off)
3. Generator
4. Gasket

HA 2258
M1-0100-77-427
26815

HP Tachometer Generator - Removal and Installation
Figure 401

LOW-PRESSURE (N1) ENGINE SHAFT SPEED INDICATOR REMOVAL AND INSTALLATION

1. Removal/Installation

   A. Removal

      (1) On the Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag the applicable TACH N1 and ENG INSTR RESET circuit breakers.

      On the Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breaker CTR INSTR & GLARE SHLD.

      (2) Locate the low-pressure (LP) N1 engine shaft speed indicator between the engine pressure ratio (EPR) and turbine gas temperature (TGT) indicators, and loosen captive triwing fasteners (Ref. Fig. 401).

      (3) Withdraw indicator from panel far enough to permit separation of two electrical receptacle connectors from indicator.

      (4) Tape and stow both electrical connectors.

   B. Installation

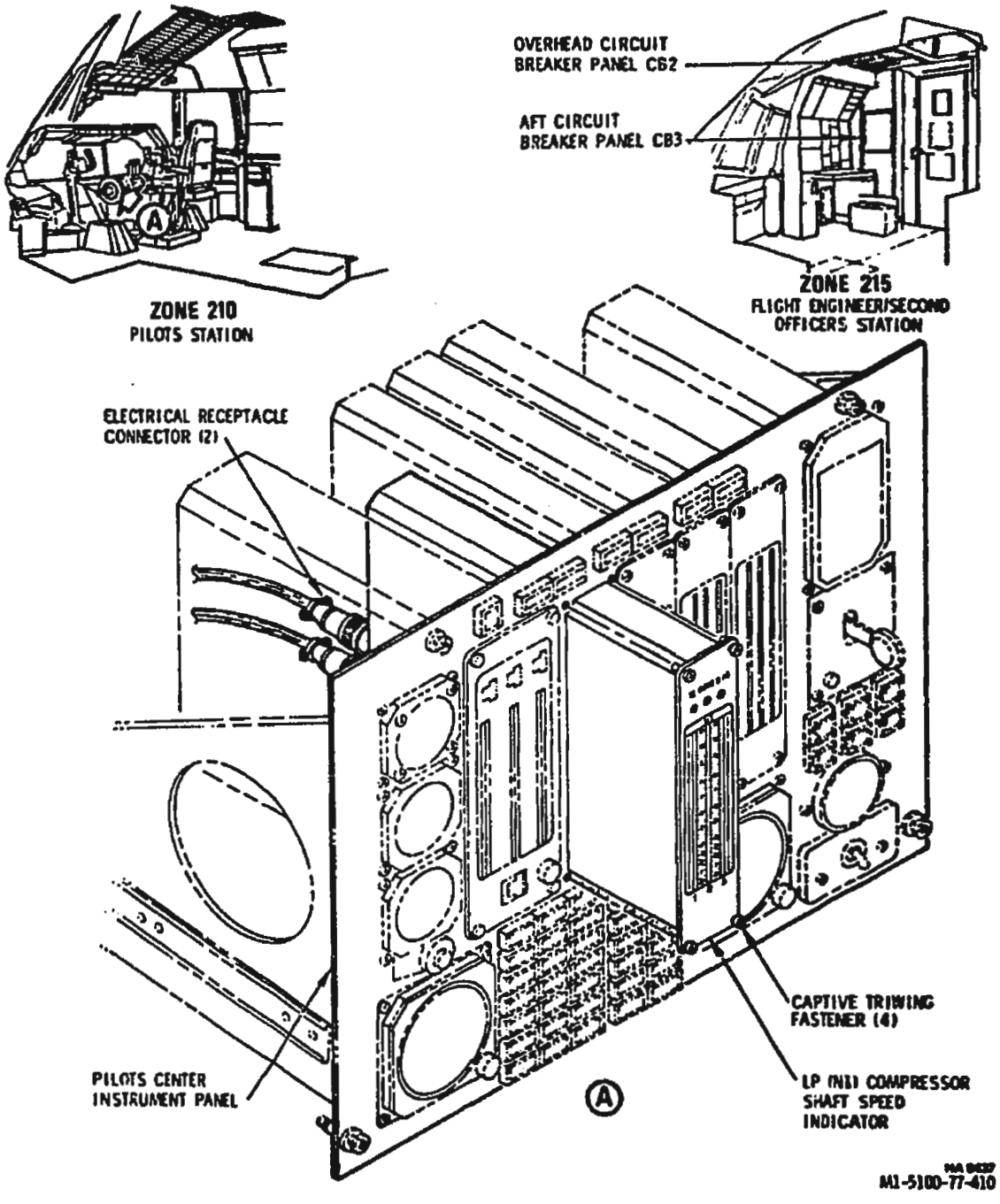
      (1) Verify that circuit breakers opened in Step A(1) are open and tagged.

      (2) Connect electrical connectors to indicator.

      (3) Slide indicator into panel cutout until flange contacts panel. Secure indicator by tightening triwing fateners.

      (4) Remove tags and close circuit breakers opened in Step A(1).

      (5) During the next engine motoring or runup procedure, verify that indicator performs satisfactorily.



Low-pressure (N1) Engine Shaft Speed Indicator
Removal and Installation
Figure 401

IP (N2) ENGINE SHAFT SPEED INDICATOR - REMOVAL AND INSTALLATION

1. Referenced Procedure

   77-12-06 IP (N2) Engine Shaft Speed Indicator - Adjustment and Test

2. Removal/Installation

   A. Removal

      (1) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag the applicable ENG NO. 1/2/3 TACH N2 (P3, P9, or P15) circuit breaker.

      (2) Locate intermediate-pressure (IP) N2 engine shaft speed indicators on Flight Engineer/Second Officers ENGINE STATUS panel, zone 215.

      (3) Loosen clamp screw that secures applicable N2 shaft speed indicator in panel (Ref. Fig. 401).

      (4) Withdraw indicator from panel and disconnect the electrical connector. Tape and stow harness connector.

   B. Installation

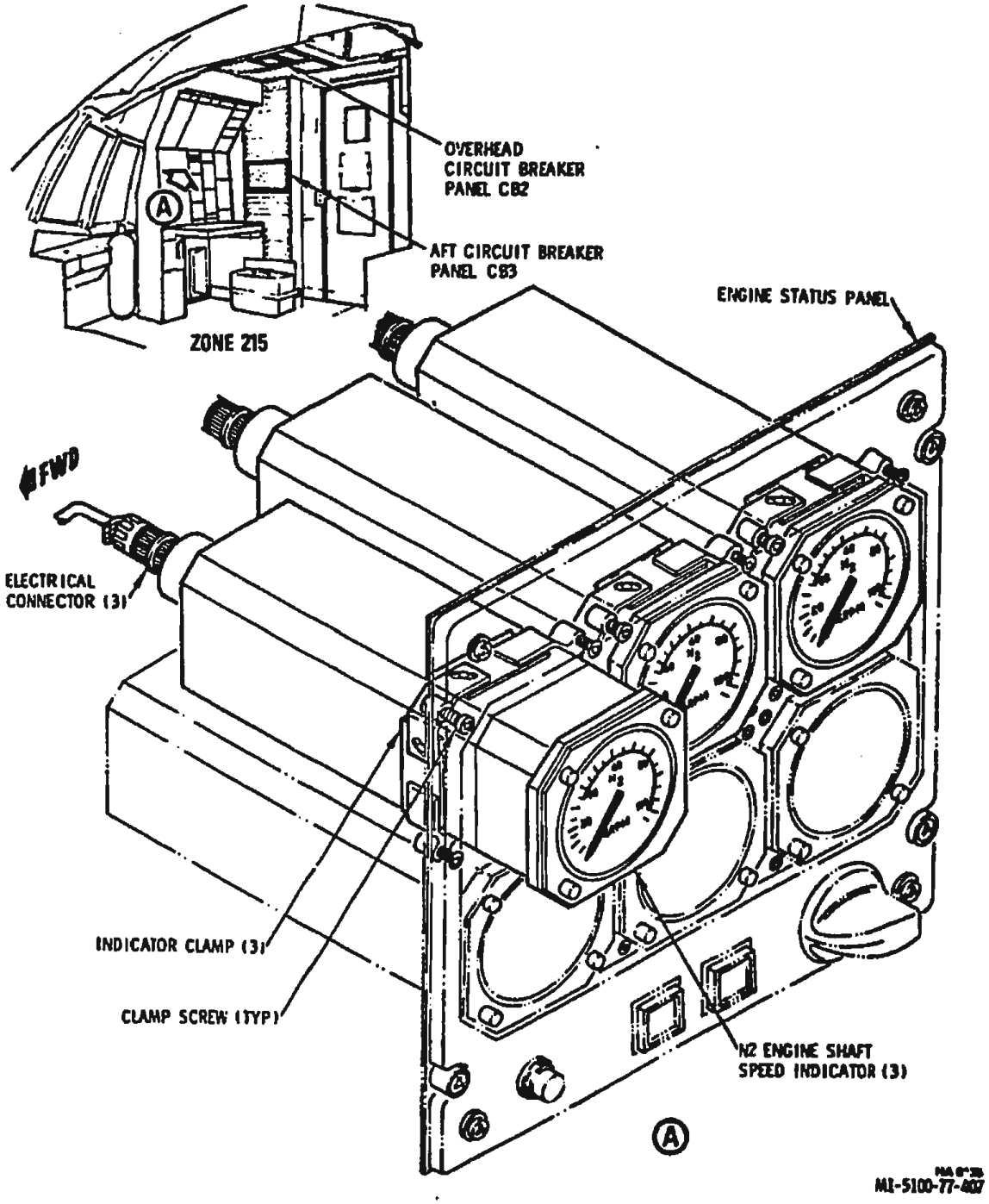
      (1) Verify that circuit breakers opened in Step 2A(1) are open and tagged.

      (2) Mate electrical connector on harness to connector on indicator.

      (3) Slide indicator into applicable panel cutout until bezel is positioned against panel. Secure indicator by tightening clamp screw.

      (4) Remove tags and close circuit breakers opened in Step 2A(1).

      (5) Perform BITE test (Ref. 77-12-06).



Intermediate-pressure (N2) Engine Shaft Speed Indicator
Removal and Installation
Figure 401

IP_(N2)_ENGINE_SHAFT_SPEED_INDICATOR_-_ADJUSTMENT_AND_TEST

1. Referenced_Procedure

24-41-00 External Power/Ground Service System - Maintenance Practices

2. Adjustment/Test

A. BITE Test

(1) Turn on electrical power (Ref. 24-41-00).

(2) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify that applicable circuit breaker TACH N2 (P3, P9, or P15) is closed.

(3) On Flight Engineer/Second Officers lower panel, zone 215, locate applicable N2 indicator and the built-in test equipment (BITE) switch in the lower left corner of the indicator.

R (4) On aircraft 001-031 without SB77-032, depress BITE switch and verify that indicator pointer
R drives to approximately 12 o'clock position.

R (4) On aircraft 001-031 with SB77-032 and 032-999, depress BITE switch and verify that indicator pointer
R drives to approximately the 91% RPM position.

R (5) Release BITE switch and verify that pointer returns to
R zero.

(6) Turn off electrical power (Ref. 24-41-00).

HIGH-PRESSURE (N3) ENGINE SHAFT SPEED INDICATOR MAINTENANCE PRACTICES

1. General

The following procedure specifies the method used to deactivate the N3 engine shaft speed indication system.

R NOTE: This deactivation procedure applies only when an aircraft
R is to be dispatched in accordance with the MEL.

2. Deactivation

A. N3 Indicator

(1) Install appropriate placard in flight station.

(2) Make appropriate entry in aircraft log book.

HIGH-PRESSURE (N3) ENGINE SHAFT SPEED INDICATOR REMOVAL AND INSTALLATION

1. Removal/Installation

   A. Removal

      (1) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag circuit breaker TGT WARN (R11).

      On pilots overhead circuit breaker panel CB1, zone 210, open and tag circuit breakers TACH N3 ENG 1, 2, and 3 (E10, E11, and E12).

      (2) Locate the high-pressure (HP) N3 engine shaft speed indicator on the pilots center instrument panel, and loosen captive Tri-wing fasteners.

      (3) Withdraw indicator from panel and disconnect electrical connectors.

      (4) Tape and stow electrical connectors.

   B. Installation

      (1) Verify that circuit breakers opened in Step A(1) are open and tagged.

      (2) Remove tape and connect electrical connectors.

      (3) Slide indicator into panel cutout until flange contacts panel. Secure indicator by tightening Tri-wing fasteners.

      (4) Remove tags and close circuit breakers opened in Step A(1).

      (5) Verify that indicator performs satisfactorily during next engine run.

CR RATED ENGINE PRESSURE RATIO COMPUTER SYSTEM
CR DESCRIPTION AND OPERATION

CR 1. General

CR The rated engine pressure ratio (EPR) computer system is a pilot aid that computes and displays rated EPR relating to altitude, airspeed, air temperature, bleed air, and selected mode. The selected mode corresponds to the flight condition of takeoff, climb, cruise, or go-around.

CR EPR is proportional to thrust at a given flight condition and is defined as the ratio of the weighted average pressure at the engine fan and turbine exhaust nozzles, to the inlet pressure. The system provides an automatically computed indication of rated EPR for setting engines to a specified thrust rating. Automatic computation reduces flight crew workload and simplifies setting engine thrust by eliminating the procedure of reference to power charts during flight.

CR The system consists of three main components: a control panel located on the FE/SO lower panel, zone 215, an indicator located on the pilots center instrument panel, zone 210, and a computer located in the forward electronic service center (FESC), zone 113.

CR 2. Operation

CR The system interfaces with the central air data computer (CADC) No. 2, total air temperature (TAT) probe No. 2, wing and engine anti-ice control, and the environmental control system bleed control (Ref. Fig. 1). The system does not recognize engine anti-ice while on the ground. Therefore, the system can be used in takeoff mode only up to that altitude where engine anti-ice must be considered for EPR computation.

CR The rated EPR system is activated by depressing the applicable mode switchlight on the control panel. The lens on the selected mode switchlight indicates ON and the annunciator wheel on the indicator displays the selected mode. The computer receives airspeed and altitude signals from the CADC, air temperature from the TAT probe, and bleed air signals from the applicable sources.

CR The computed value of rated EPR is displayed on the RATED EPR indicator. This is a value between 1.000 and 1.999, displayed as a three digit decimal with the one (1) understood. The measured value of TAT is also displayed on the indicator which has a range of −70°C to +70°C increments.

CR 3. Rated_Engine_Pressure_Ratio_Computer

CR A. Description and Operation

CR The rated EPR computer (Ref. Fig. 2) is mounted on the upper shelf of the forward electronic service center rear avionics rack, zone 113. The computer contains a general purpose programmable arithmetic central processing unit (CPU). Synchro signals, proportional to mach number and altitude, are fed through a multiplexer, phase splitter, and demodulator. The signal is then routed, along with the TAT signal, through an analog-to-digital A/D converter to the CPU. The CPU processes this information, along with external constants of mode and bleed air conditions, and computes the rated EPR. A basic computation time for normal operation is 1/2 second.

CR The front panel of the computer contains two electrical test receptacles and two built in test equipment (BITE) indicators. White flags appear in the applicable BITE indicator to indicate a failure of the RATED EPR indicator or the computer. A failure of TAT will cause a RATED EPR indicator failure indication.

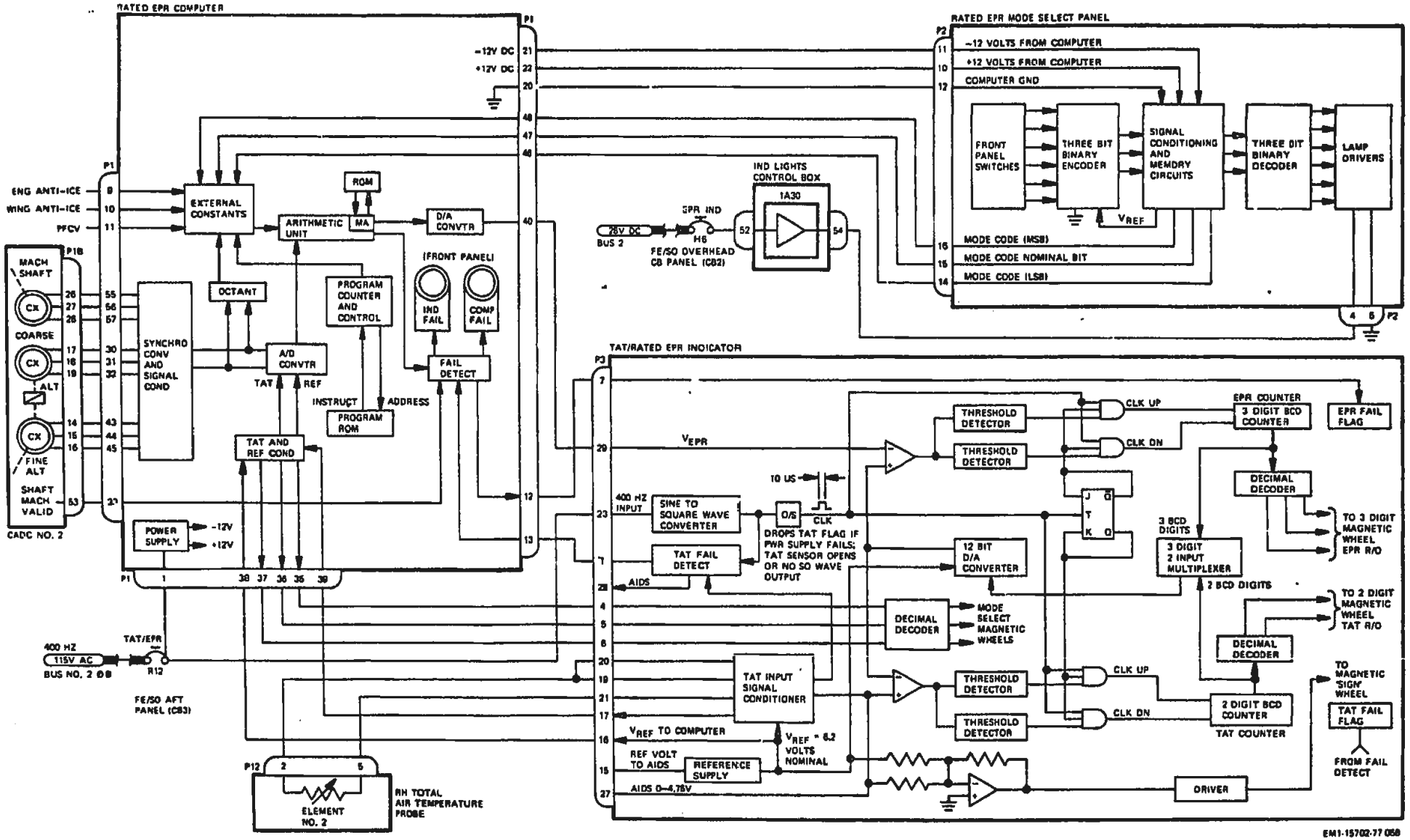
CR 4. Rated_Engine_Pressure_Ratio_Indicator

CR A. Description and Operation

CR The rated engine pressure ratio (EPR) indicator is mounted on the pilots center instrument panel, zone 210. It is a digital readout, round-dial indicator housed in a standard 2 ATI case (Ref. Fig. 3). Computed value of rated EPR, measured value of TAT, and selected mode are displayed on the indicator magnetic annunciator wheels.

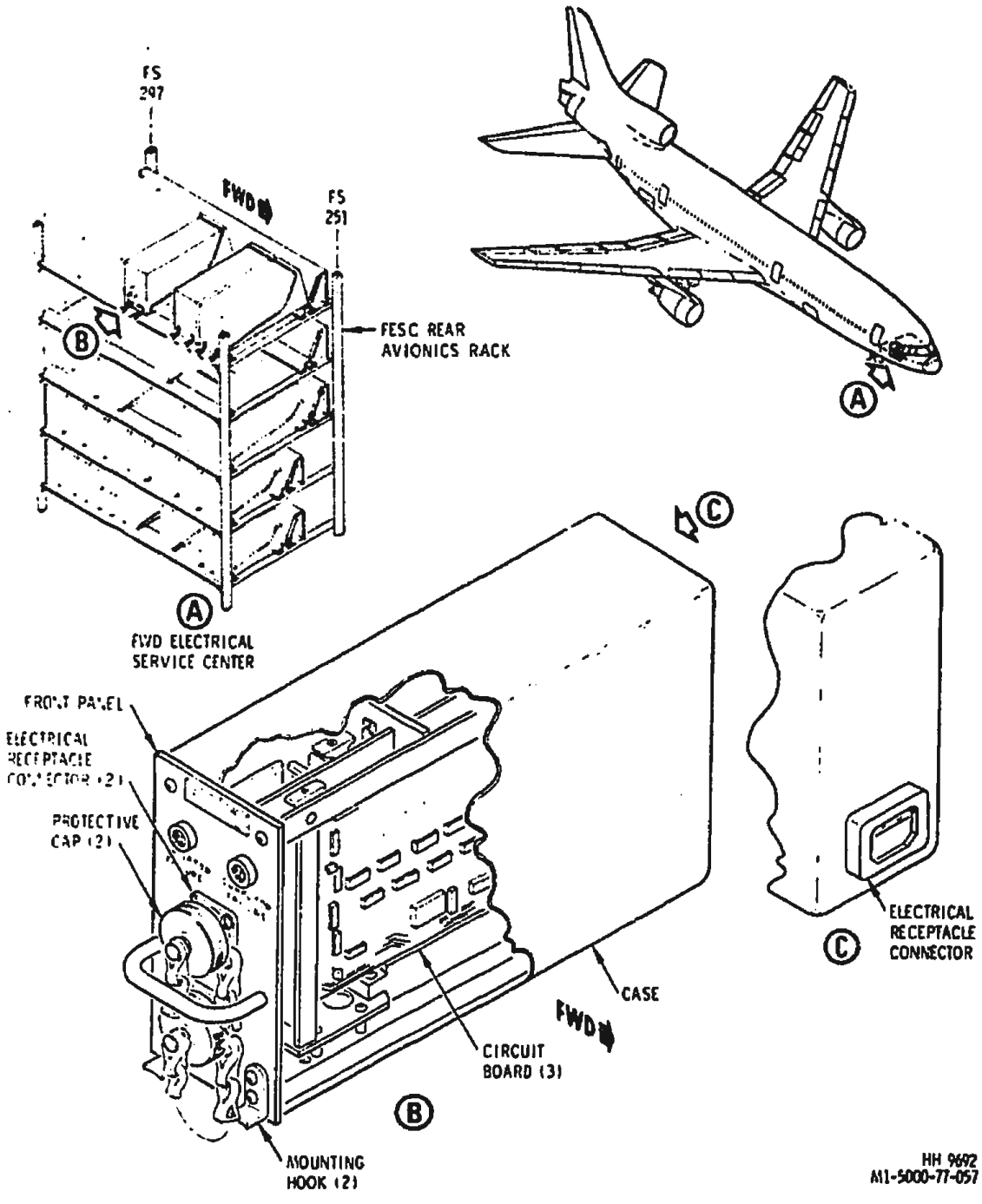
CR Rated EPR signals from the computer are fed to the differential amplifier of a dual digital servo (TAT/EPR) with a common feedback circuit. The differential amplifier output drives a pulse circuit which drives a binary coded decimal (BCD) counter. This BCD counter then feeds the EPR wheel driver, and through an analog switch (multiplexer), a BCD-to-analog converter. The output of the converter is the feedback signal to the differential amplifier. Timing circuits control the counting circuits and analog switch.

CR The indicator also receives a resistance signal from the TAT probe which is proportional to the true air temperature. Using this as one leg of a bridge circuit, the indicator computes and displays TAT. The TAT function computation is independent of the computer and the control panel such that



Rated EPR Simplified Schematic
Figure 1

EFFECTIVITY: ALL - MAGNETIC WHEEL TYPE



CR
CR

Rated EPR Computer
Figure 2

EFFECTIVITY: ALL - MAGNETIC WHEEL TYPE

CR failure or removal of one or both will not effect the
CR indicator TAT readout capability.

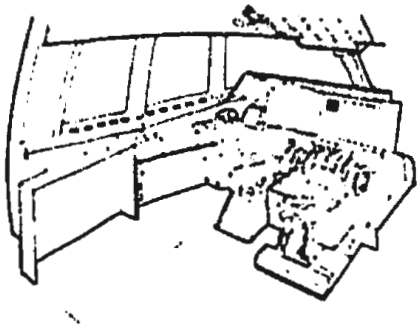
CR The indicator has an EPR flag and a TAT flag for failure
CR annunciations. The CADC provides a validity signal to the
CR computer BITE circuits which operate the indicator EPR flag
CR and the computer EPR BITE flag. The TAT signal is monitored
CR for excursions beyond the range of the system. A short or
CR open in the sensor or interconnecting wiring will trigger
CR the monitor. This monitor will activate the TAT flag on the
CR indicator and also send a signal to the computer BITE
CR circuits. TEMP PROBE HEAT on while on the ground will cause
CR the TAT & SAT flags to appear.

CR 5. Engine Pressure Ratio Control Panel

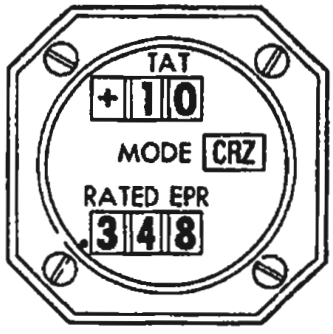
CR A. Description and Operation

CR The RATED EPR MODE control panel (Ref. Fig. 4), located on
CR the Flight Engineer/Second Officers lower panel, zone 215,
CR houses switchlights for selecting the applicable rated EPR
CR mode. The control panel provides four rated EPR modes - TO
CR (takeoff), CLB (climb), CRZ (cruise), and GA (go-around).

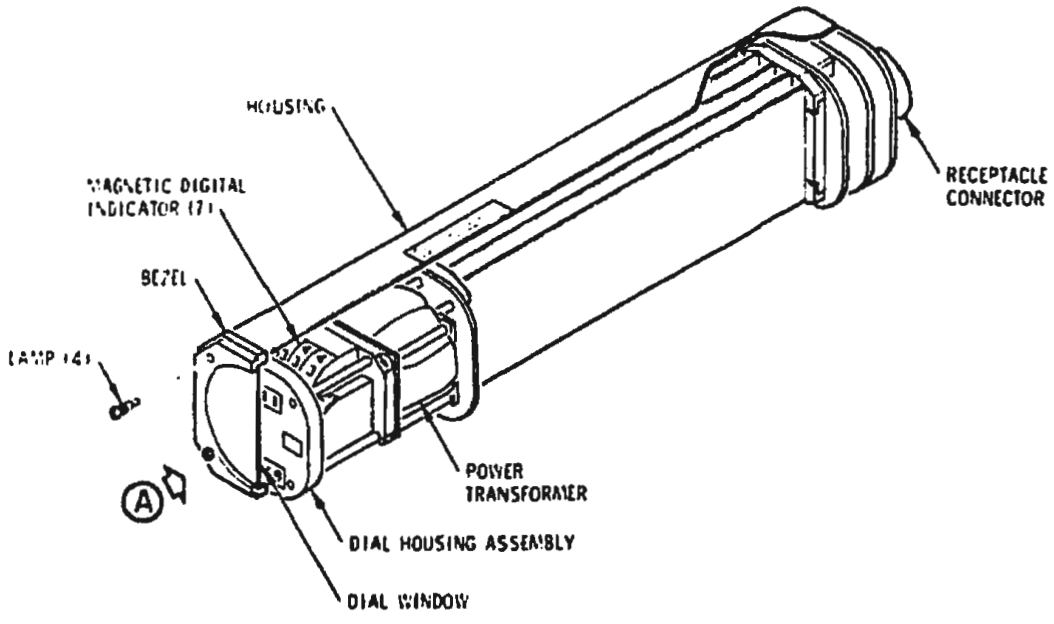
CR The control panel switchlights are momentary pushbutton
CR type. Depressing one of the mode switchlights illuminates
CR the applicable switch lens, drives the computer to the
CR applicable mode, and displays the selected mode on the
CR indicator (Ref. Fig. 5). The lens ON illumination indicates
CR contact closure to the three-bit binary encoder. The binary
CR encoder furnishes a signal to the signal conditioning and
CR memory circuits. The memory circuit consists of an
CR operational amplifier and related components, and is capable
CR of storing the mode for 30 seconds of power outage.



ZONE 21U



Ⓐ



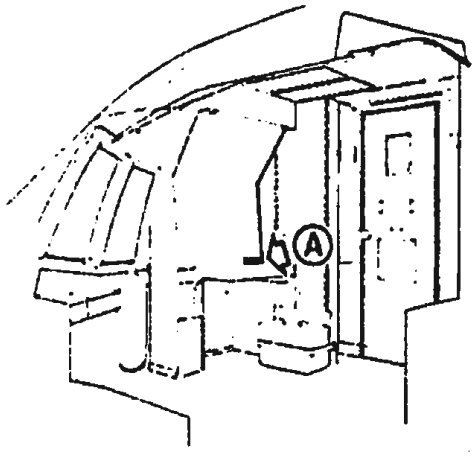
HH 9350
M1-5000-77-056

CR
CR

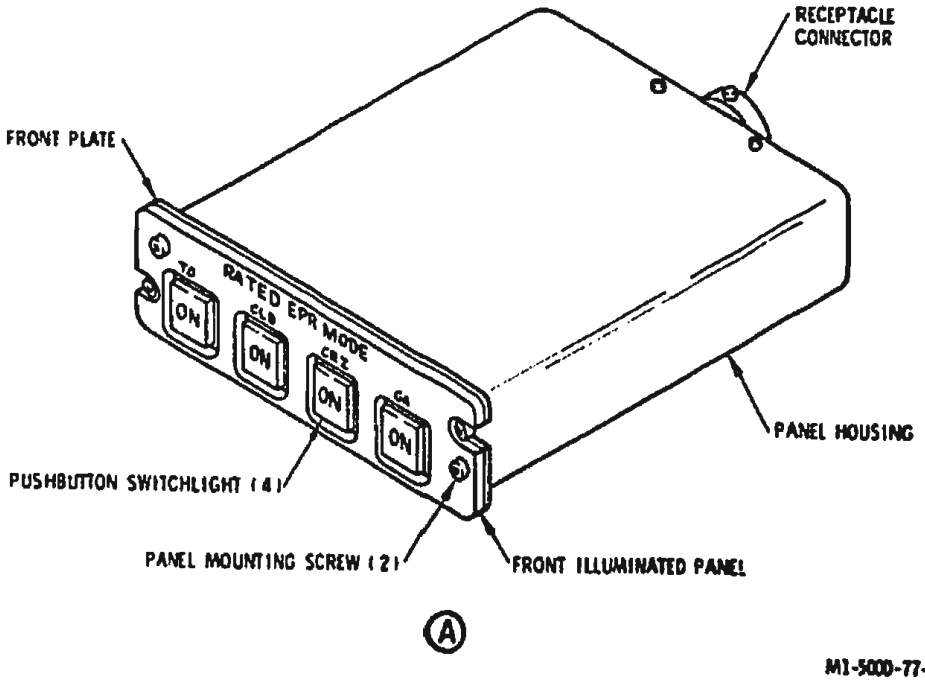
Rated EPR Indicator
Figure 3

EFFECTIVITY: ALL - MAGNETIC WHEEL TYPE

001R



ZONE 215



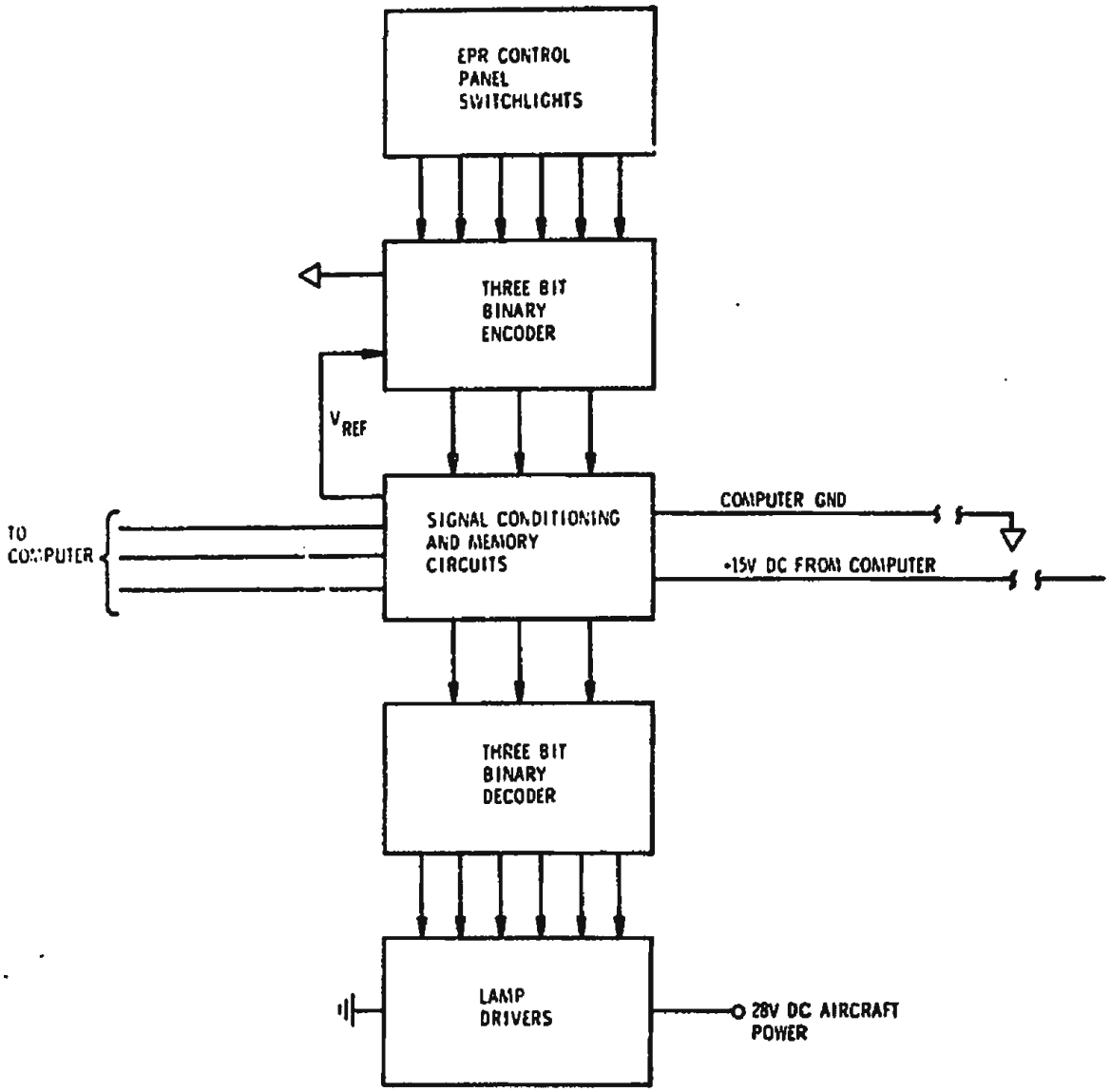
M1-5000-77-084

CR
CR

Rated EPR Control Panel
Figure 4

EFFECTIVITY: ALL - MAGNETIC WHEEL TYPE

001R



HH 9286
EM1-5000-77-053

CR
CR

Rated EPR Control Panel Block Diagram
Figure 5

EFFECTIVITY: ALL - MAGNETIC WHEEL TYPE

CR RATED ENGINE PRESSURE RATIO COMPUTER SYSTEM
CR DESCRIPTION AND OPERATION

CR 1. General

CR The rated engine pressure ratio (EPR) computer system is a pilot aid that computes and displays rated EPR relating to altitude, airspeed, air temperature, bleed air, and selected mode. The selected mode corresponds to the flight condition of takeoff, climb, cruise, or go-around.

CR EPR is proportional to thrust at a given flight condition and is defined as the ratio of the weighted average pressure at the engine fan and turbine exhaust nozzles, to the inlet pressure. The system provides an automatically computed indication of rated EPR for setting engines to a specified thrust rating. Automatic computation reduces flight crew workload and simplifies setting engine thrust by eliminating the procedure of reference to power charts during flight.

CR The system consists of three main components: a control panel located on the FE/SO lower panel, zone 215, an indicator located on the pilots center instrument panel, zone 210, and a computer located in the forward electronic service center (FESC), zone 113.

CR 2. Operation

CR The system interfaces with the central air data computer (CADC) No. 2, total air temperature (TAT) probe No. 2, wing and engine anti-ice control, and the environmental control system bleed control (Ref. Fig. 1). The system does not recognize engine anti-ice while on the ground. Therefore, the system can be used in takeoff mode only up to that altitude where engine anti-ice must be considered for EPR computation.

CR The rated EPR system is activated by depressing the applicable mode switchlight on the control panel. The lens on the selected mode switchlight indicates ON and the indicator displays the selected mode. The computer receives airspeed and altitude signals from the CADC, air temperature from the TAT probe, and bleed air signals from the applicable sources.

CR The computed value of rated EPR is displayed on the RATED EPR indicator. This is a value between 1.000 and 1.999, displayed as a three digit decimal with the one (1) understood. The measured value of TAT is also displayed on the indicator which has a range of -70°C to +70°C in one degree increments.

CR 3. Rated Engine Pressure Ratio Computer

CR A. Description and Operation

CR The rated EPR computer (Ref. Fig. 2) is mounted on the upper
CR shelf of the forward electronic service center rear avionics
CR rack, zone 113. The computer contains a general purpose
CR programmable arithmetic central processing unit (CPU).
CR Synchro signals, proportional to mach number and altitude,
CR are fed through a multiplexer, phase splitter, and
CR demodulator. The signal is then routed, along with the TAT
CR signal, through an analog-to-digital converter to the CPU.
CR The CPU processes this information, along with external
CR constants of mode and bleed air conditions, and computes the
CR rated EPR. A basic computation time for normal operation is
CR 1/2 second.

CR The front panel of the computer contains two electrical test
CR receptacles and two built in test equipment (BITE)
CR indicators. White flags appear in the applicable BITE
CR indicator to indicate a failure of the RATED EPR indicator
CR or the computer. A failure of TAT will cause a RATED EPR
CR indicator failure indication.

CR 4. Rated Engine Pressure Ratio Indicator

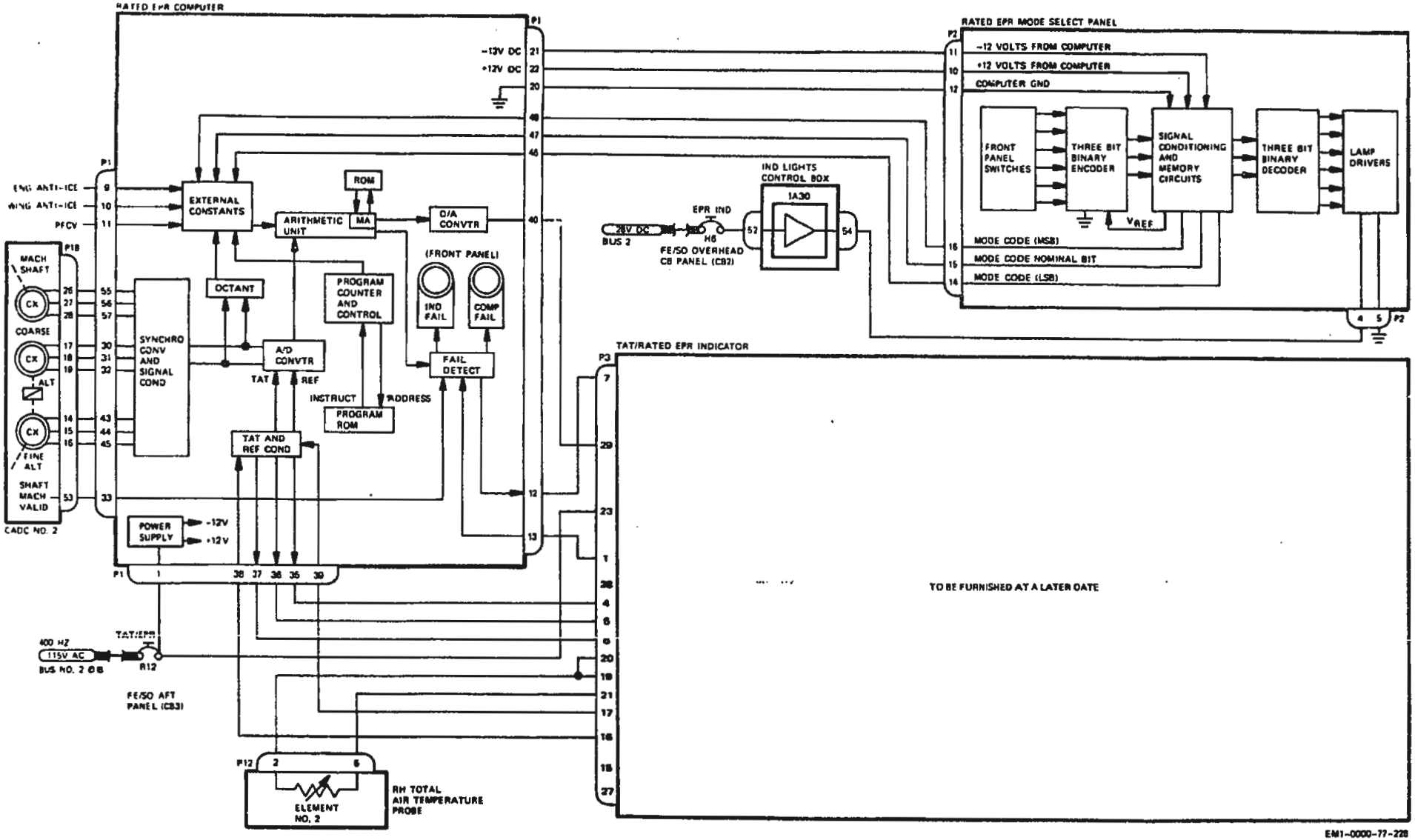
CR A. Description and Operation

CR The rated engine pressure ratio (EPR) indicator is mounted
CR on the pilots center instrument panel, zone 210. It is a
CR digital readout, round-dial indicator housed in a standard 2
CR ATI case (Ref. Fig. 3).. Computed value of rated EPR, and
CR measured value of TAT are displayed via seven (7) segment
CR solid state displays. The selected mode is displayed on
CR sixteen segment solid state displays.

CR The indicator also receives a resistance signal from the TAT
CR probe which is proportional to the true air temperature.
CR Using this as one leg of a bridge circuit, the indicator
CR computes and displays TAT. The TAT function computation is
CR independent of the computer and the control panel such that
CR failure or removal of one or both will not affect the
CR indicator TAT readout capability.

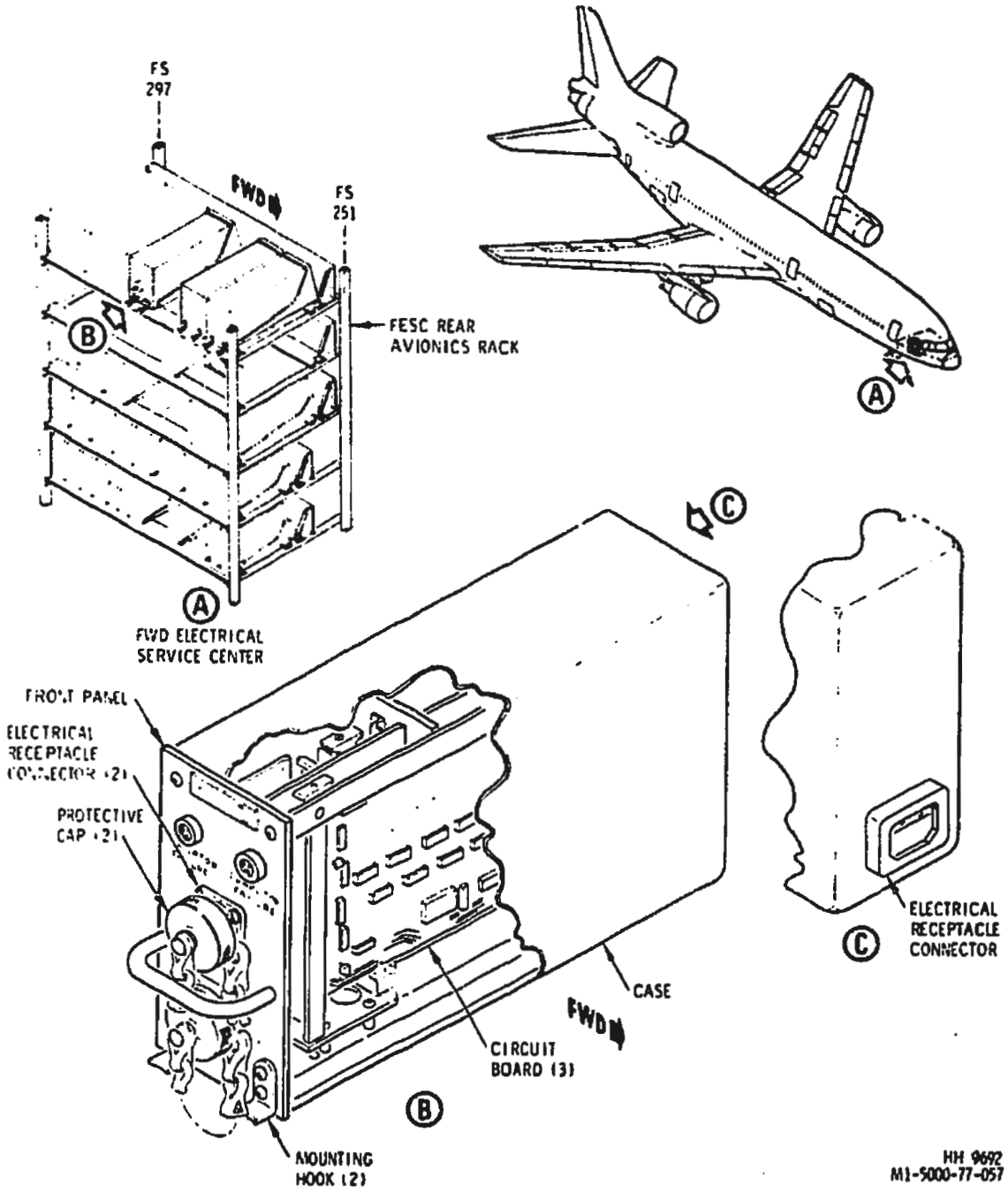
CR The TAT or EPR display blanks out if a system or segment
CR failure occurs. The TAT display also blanks out if the
CR temperature exceeds ±77 degrees.

CR Blanking out of the displays also occurs if the upper and/or
CR center horizontal segments fail when that specific segment
CR is required to be lighted. Depressing and holding the test



Rated EPR Simplified Schematic
Figure 1

EFFECTIVITY: ALL - SOLID STATE TYPE



CR
CR

Rated EPR Computer
Figure 2

R
R
R
R

EFFECTIVITY: ALL - SOLID STATE TYPE

0028

CR switch illuminates all segments of the display; the TAT
CR minus sign will have all three horizontal segments lighted.
CR This will identify which segment has failed. Releasing the
CR test switch will result in the TAT and EPR values being
CR displayed, minus the failed segment for approximately 10
CR seconds. After 10 seconds, the display again blanks out.

CR When TAT is a minus temperature, the center horizontal
CR segment of the left most display will be lighted. If this
CR segment fails, the upper and lower horizontal segments will
CR illuminate.

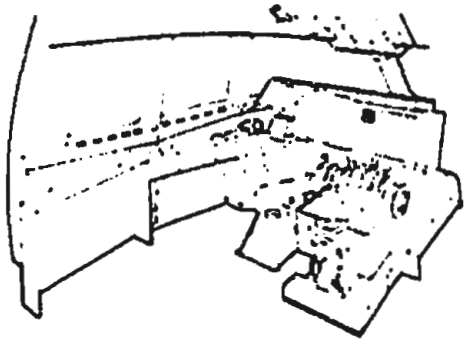
CR Indicator dimming is via the center instrument panel control
CR located on the left hand side of pedestal. With dimming
CR control in full counter clockwise position (OFF), the
CR indicator segmented displays are bright for daytime
CR operation. Rotating the dimming control clock-wise just
CR extinguishes the segmented displays. Further clockwise
CR rotation of dimming control will provide increasing light
CR intensity that matches the other instruments on the center
CR instrument panel. Full clockwise position of the dimming
CR control is full nighttime intensity and is less than daytime
CR intensity.

CR 5. Engine Pressure Ratio Control Panel

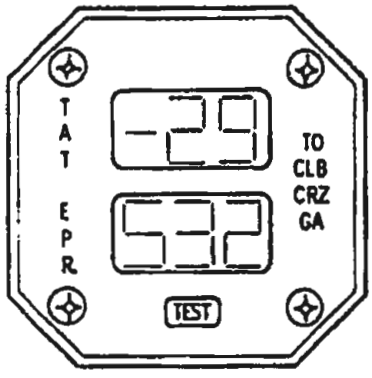
CR A. Description and Operation

CR The RATED EPR MODE control panel (Ref. Fig. 4), located on
CR the Flight Engineer/Second Officers lower panel, zone 215,
CR houses switchlights for selecting the applicable rated EPR
CR mode. The control panel provides four rated EPR modes - TO
CR (takeoff), CLB (climb), CRZ (cruise), and GA (go-around).

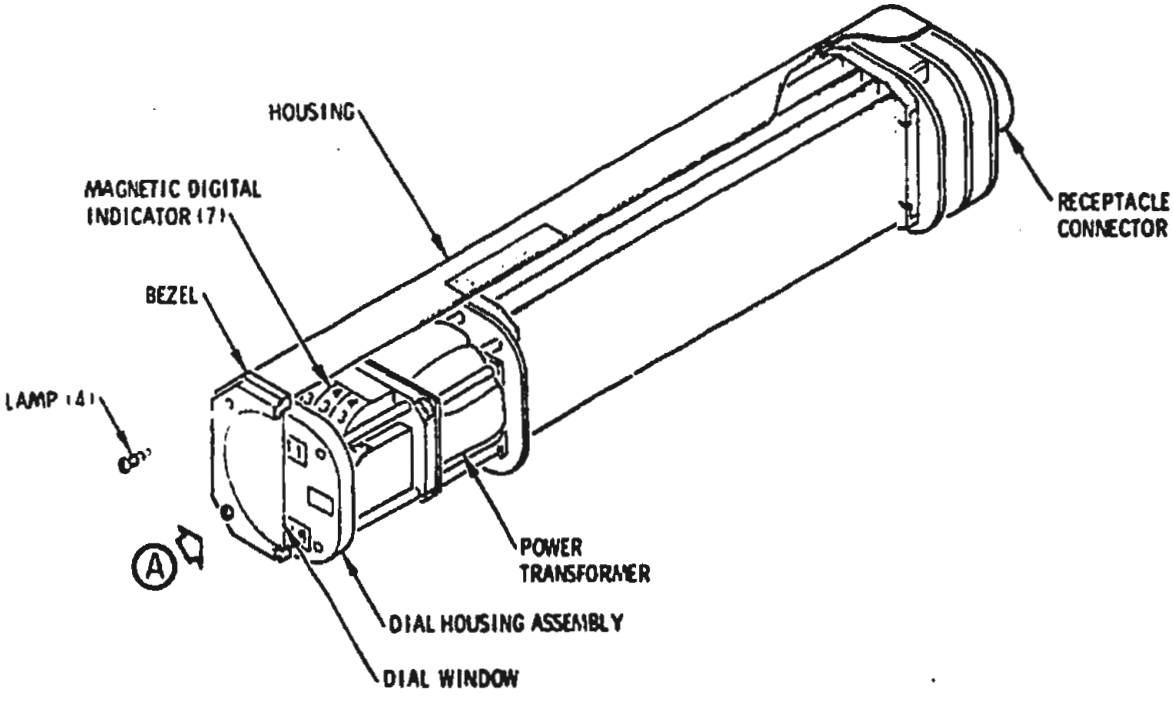
CR The control panel switchlights are momentary pushbutton
CR type. Depressing one of the mode switchlights illuminates
CR the applicable switch lens, drives the computer to the
CR applicable mode, and displays the selected mode on the
CR indicator (Ref. Fig. 5). The lens ON illumination indicates
CR contact closure to the three-bit binary encoder. The binary
CR encoder furnishes a signal to the signal conditioning and
CR memory circuits. The memory circuit consists of an
CR operational amplifier and related components, and is capable
CR of storing the mode for 30 seconds of power outage.



ZONE 210



Ⓐ

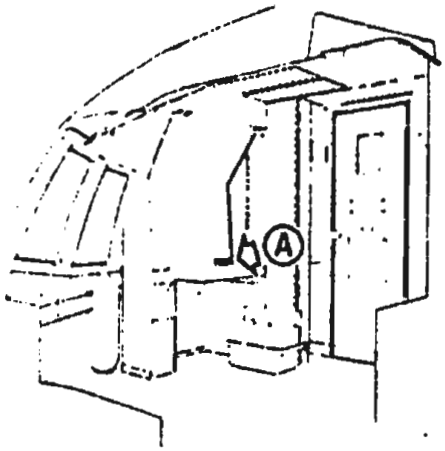


M1-0000-77-230

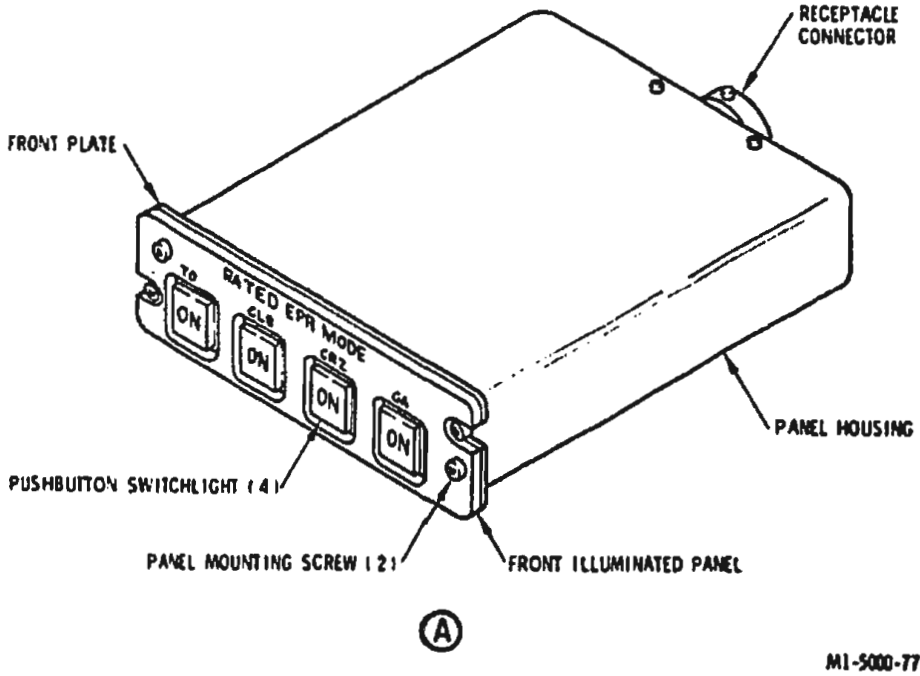
CR
CR

Rated EPR Indicator
Figure 3

R EFFECTIVITY: ALL - SOLID STATE TYPE
R
R
002R



ZONE 215

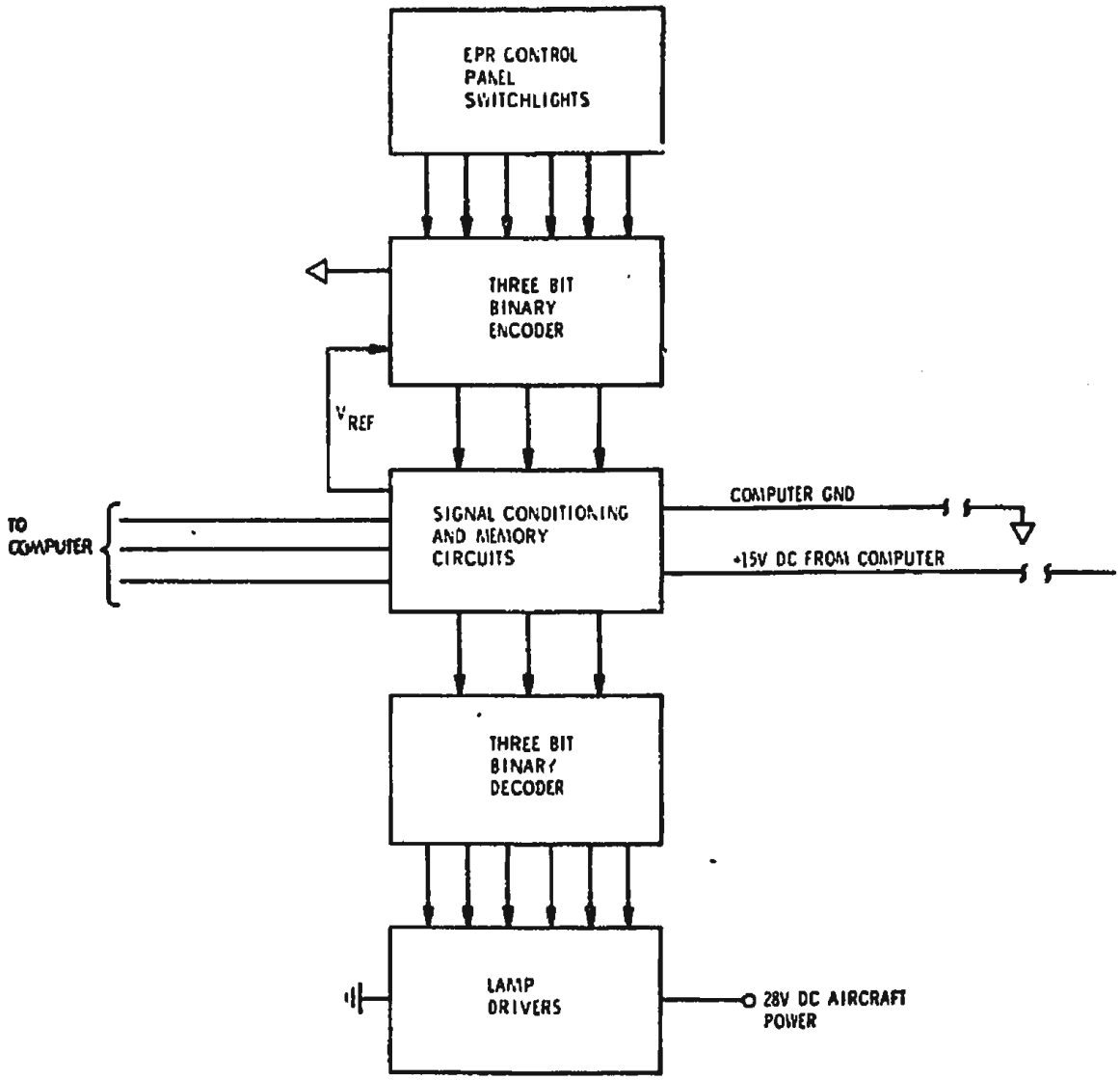


CR
CR

Rated EPR Control Panel
Figure 4

R
R
R
C002A

EFFECTIVITY: ALL - SOLID STATE TYPE



HH 9286
EM1-5000-77-053

CR
CR

Rated EPR Control Panel Block Diagram
Figure 5

R
R
R

EFFECTIVITY: ALL - SOLID STATE TYPE

0028

CR RATED ENGINE PRESSURE RATION COMPUTER SYSTEM
CR FAULT ISOLATION

CR 1. General

CR The fault isolation diagrams in this section can be used for fault isolation any time a fault is reported or suspected. Before fault isolation is started, the PREREQUISITES listed on the diagram must be fulfilled.

CR If the flight crew reports a trouble using a FIRM Fault Code number, the number can be found in the FIRM Fault Code Cross Reference Table in the Chapter 77 INDEX.

CR The FIRM Fault Code Cross Reference Table includes the flight report (fault symptoms) and the exact Section, Figure, Sheet, and Block number where fault isolation should begin. (Refer to the L-1011 Maintenance Manual Introduction for a more detailed explanation on the use of fault isolation diagrams.)

CR If a fault is reported or suspected and no FIRM Fault Code is available, the function or fault indication can be found in the table below. When a diagram is selected in this manner fault isolation is started at Block 1.

CR 2. Fault Isolation/Identification

CR Table 101 is a list of fault isolation data in this section of the manual.

CR Fault Isolation Data
CR Table 101

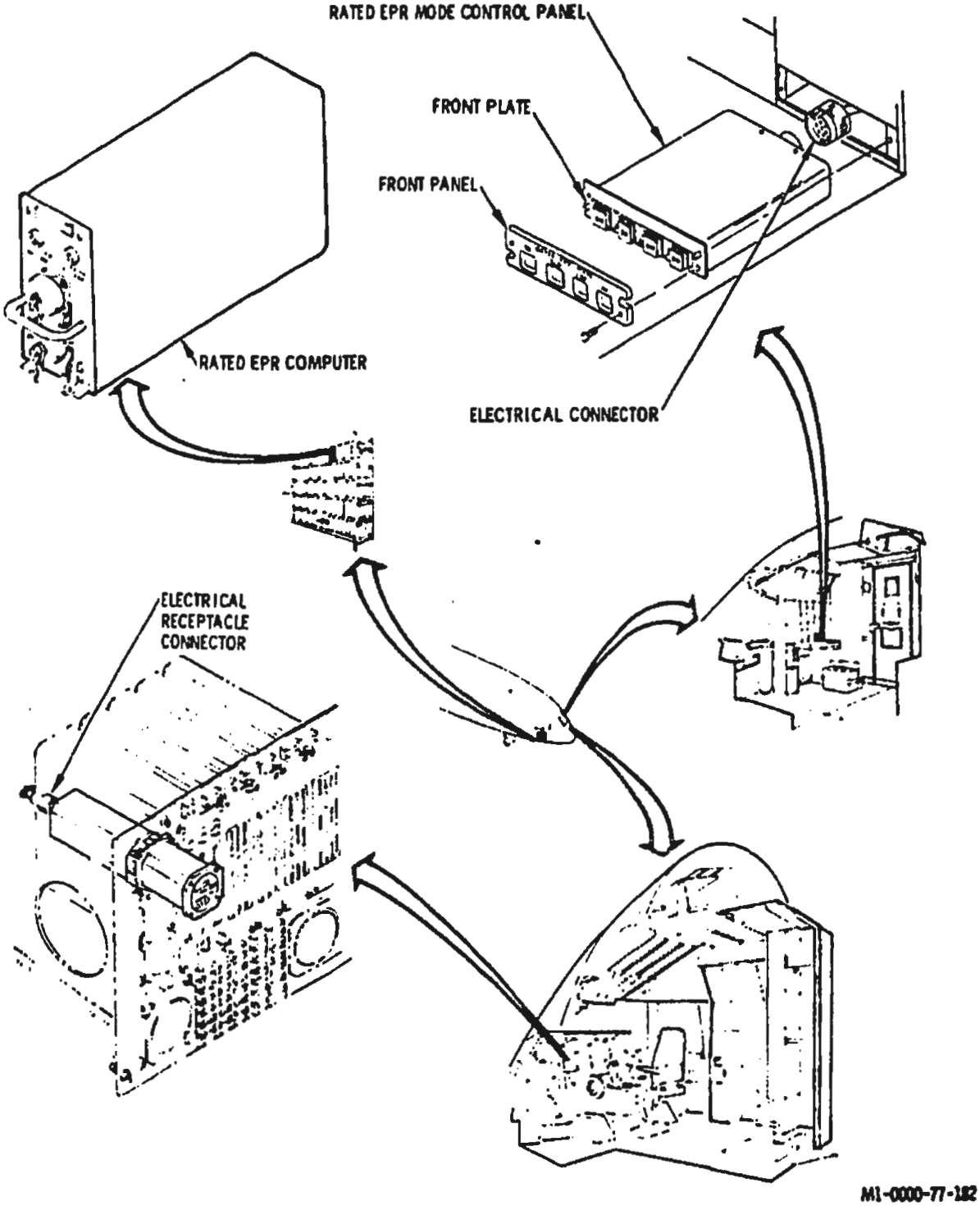
FIGURE	TITLE
101	Rated EPR Component Locator Index
102	Component Locator
103	Rated EPR Indication
104	Selected Mode Not Annunciated
105	Rated EPR Indicator Flags
106	Rated EPR Mode Switch Not Lighted
SCHEM 1	Rated EPR Circuits

COMPONENT	QTY	AREA/ACCESS	REFERENCE
COMPUTOR	1	FESC/112AB	77-13-01
INDICATOR	1	FLT STATION/PILOT CENTER INST PANEL	77-13-02
CONTROL PANEL	1	FLT STATION/FE/SO LOWER PANEL	77-13-03

M1-0000-77-179

CR Rated EPR Component Locator Index
CR Figure 101

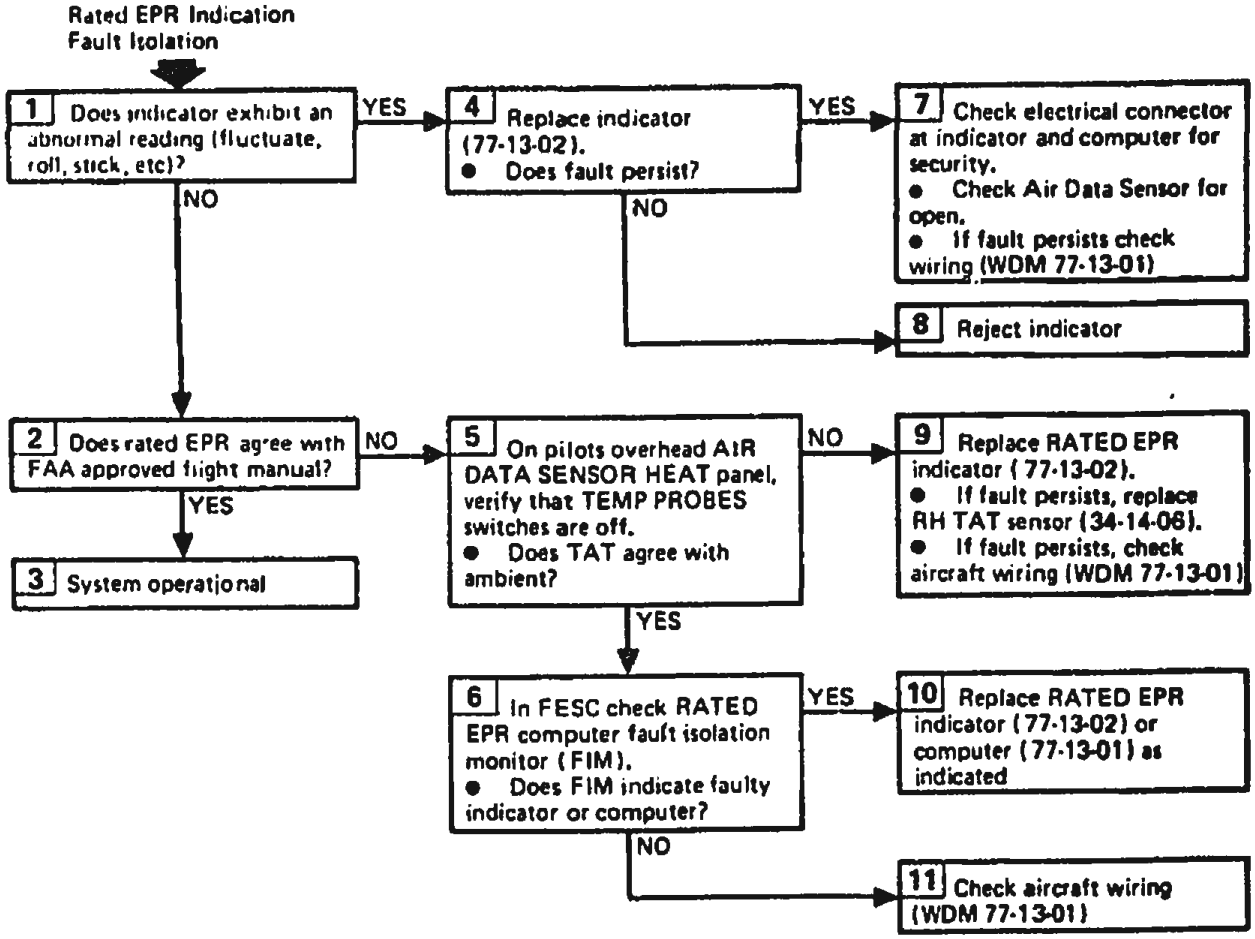
EFFECTIVITY: ALL - MAGNETIC WHEEL TYPE



CR
CR

Component Locator
Figure 102

EFFECTIVITY: ALL - MAGNETIC WHEEL TYPE


Rated EPR Indication
Fault Isolation
1 Does indicator exhibit an abnormal reading (fluctuate, roll, stick, etc)?
YES
NO
4 Replace indicator (77-13-02).
• Does fault persist?
YES
NO
7 Check electrical connector at indicator and computer for security.
• Check Air Data Sensor for open.
• If fault persists check wiring (WDM 77-13-01)
8 Reject indicator
2 Does rated EPR agree with FAA approved flight manual?
NO
YES
3 System operational
5 On pilots overhead AIR DATA SENSOR HEAT panel, verify that TEMP PROBES switches are off.
• Does TAT agree with ambient?
NO
YES
9 Replace RATED EPR indicator (77-13-02).
• If fault persists, replace RH TAT sensor (34-14-06).
• If fault persists, check aircraft wiring (WDM 77-13-01)
6 In FESC check RATED EPR computer fault isolation monitor (FIM).
• Does FIM indicate faulty indicator or computer?
YES
NO
10 Replace RATED EPR indicator (77-13-02) or computer (77-13-01) as indicated
11 Check aircraft wiring (WDM 77-13-01)

PREREQUISITES

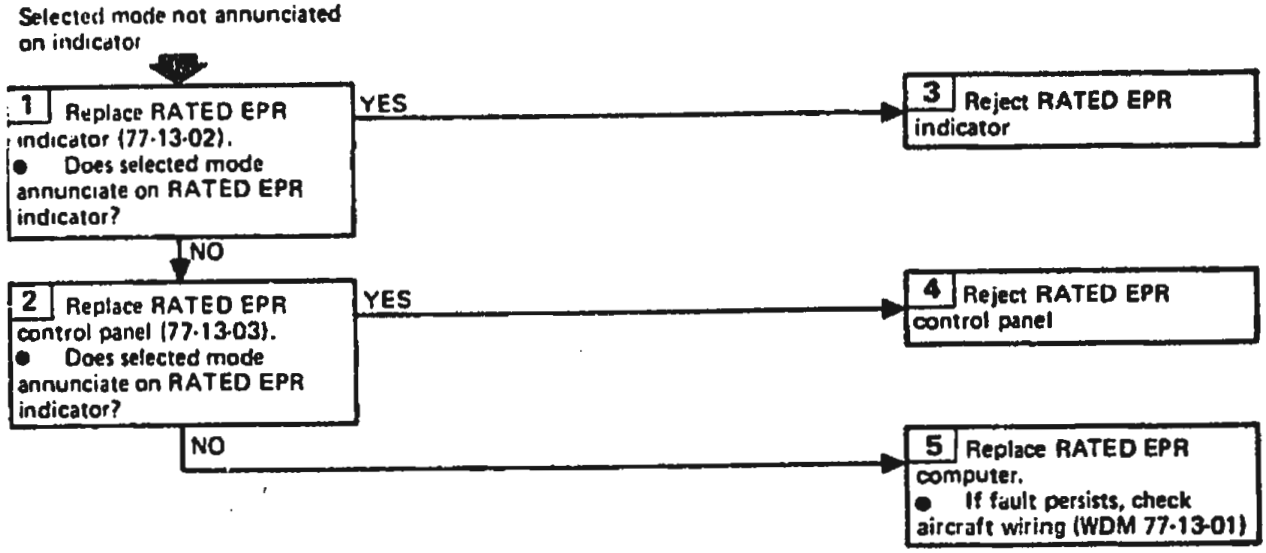
Electrical Pwr (24-41-00)
CB's closed:
CB1-F19, G27, H3, H4, and H5
CB2-D15, D19, D20, D22, E20, H6, and L8
CB3-R12

M1-27603-77-114

CR
CR

Rated EPR Indication
Figure 103

EFFECTIVITY: ALL - MAGNETIC WHEEL TYPE


Selected mode not annunciated on indicator
1 Replace RATED EPR indicator (77-13-02).
● Does selected mode annunciate on RATED EPR indicator?
YES
3 Reject RATED EPR indicator
NO
2 Replace RATED EPR control panel (77-13-03).
● Does selected mode annunciate on RATED EPR indicator?
YES
4 Reject RATED EPR control panel
NO
5 Replace RATED EPR computer.
● If fault persists, check aircraft wiring (WDM 77-13-01)

PREREQUISITES
Electrical Pwr (24-41-00)
CB's closed:
CB-1 F19, G27, H3, H4, and H5
CB-2 D15, D19, D20, D22, E20, H6, and L8
CB-3 R12

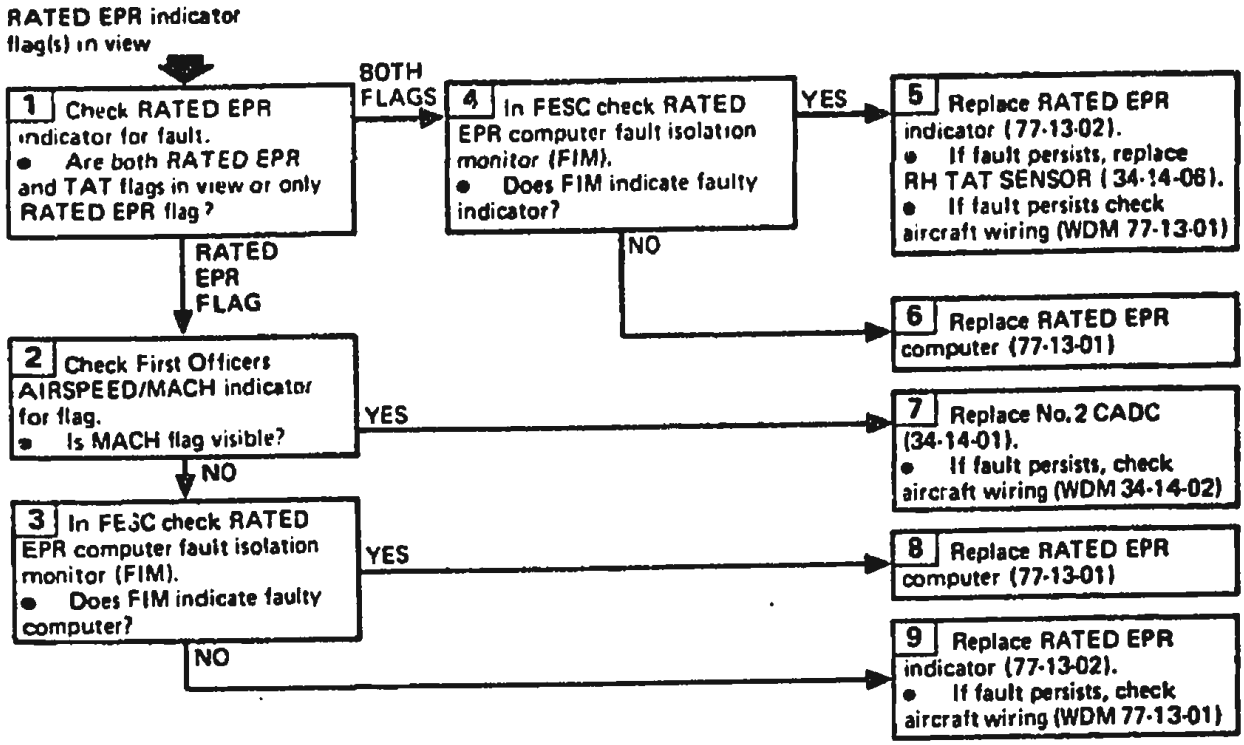
EM1-43601-77-115

CR
CR

Selected Mode Not Annunciated
Figure 104

EFFECTIVITY: ALL - MAGNETIC WHEEL TYPE

0018


RATED EPR indicator flag(s) in view
1 Check RATED EPR indicator for fault.
• Are both RATED EPR and TAT flags in view or only RATED EPR flag?
BOTH FLAGS
RATED EPR FLAG
2 Check First Officers AIRSPEED/MACH indicator for flag.
• Is MACH flag visible?
YES
NO
3 In FESC check RATED EPR computer fault isolation monitor (FIM).
• Does FIM indicate faulty computer?
YES
NO
4 In FESC check RATED EPR computer fault isolation monitor (FIM).
• Does FIM indicate faulty indicator?
YES
NO
5 Replace RATED EPR indicator (77-13-02).
• If fault persists, replace RH TAT SENSOR (34-14-06).
• If fault persists check aircraft wiring (WDM 77-13-01)
6 Replace RATED EPR computer (77-13-01)
7 Replace No.2 CADC (34-14-01).
• If fault persists, check aircraft wiring (WDM 34-14-02)
8 Replace RATED EPR computer (77-13-01)
9 Replace RATED EPR indicator (77-13-02).
• If fault persists, check aircraft wiring (WDM 77-13-01)

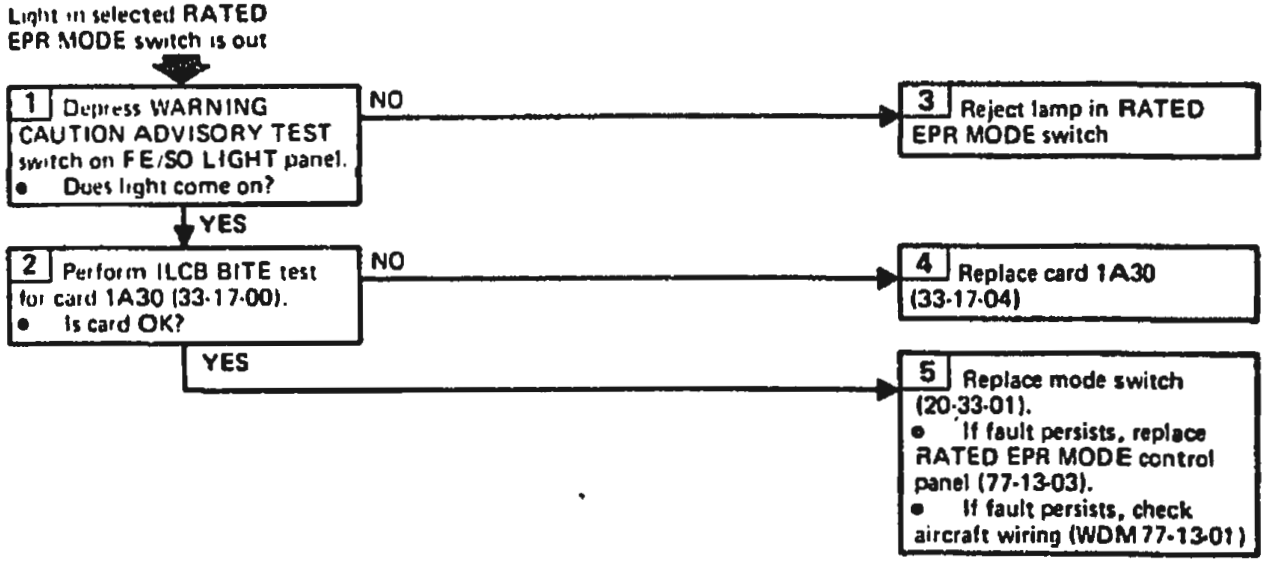
PREREQUISITES
Electrical Pwr (24-41-00)
CB's closed:
CB1-G27
-F19
CB2-H6
-E20
-L8
CB3-R12

EM1-43601-77-116

CR Rated EPR Indicator Flags
CR Figure 105

EFFECTIVITY: ALL - MAGNETIC WHEEL TYPE

001R

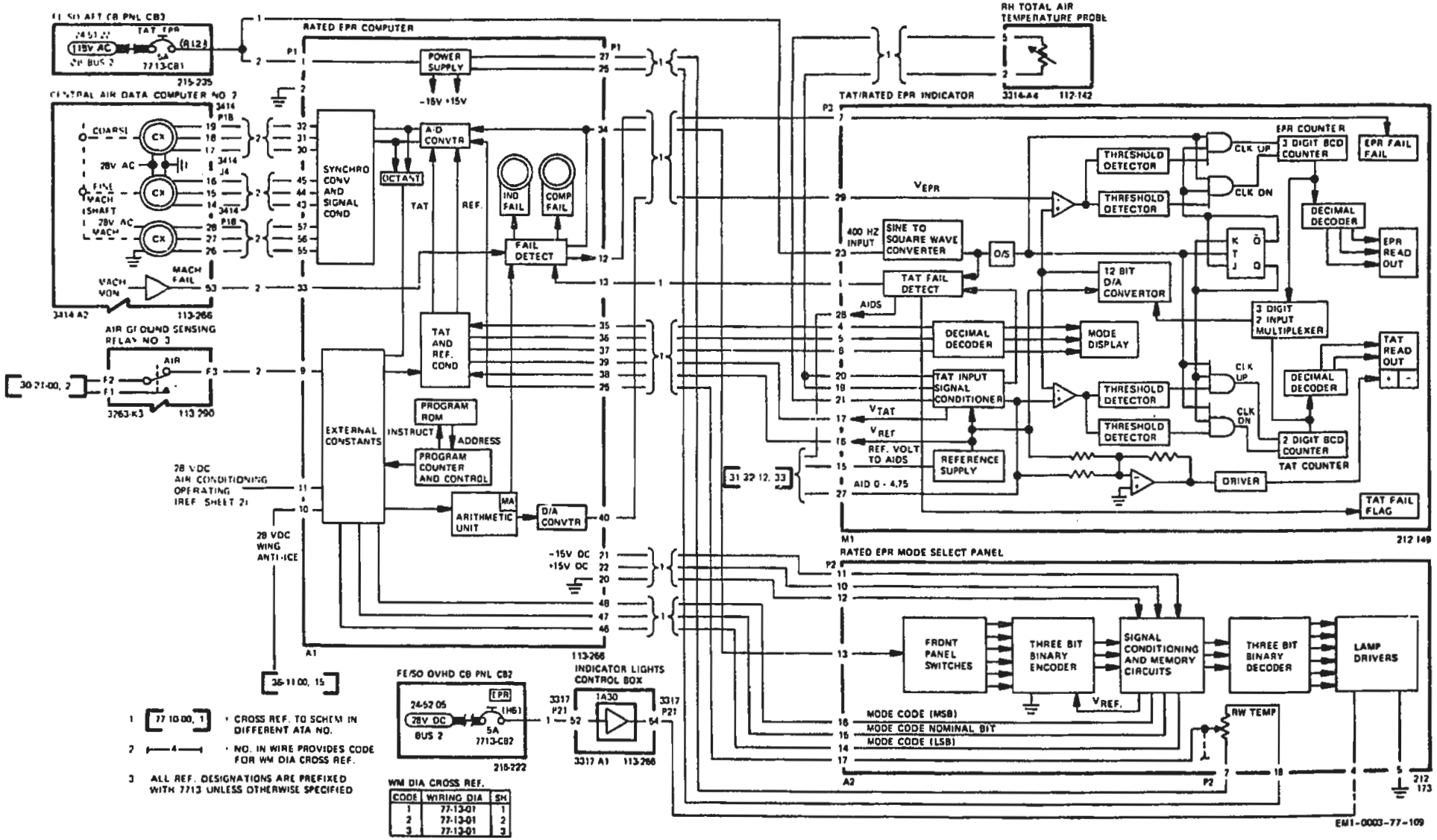

Light in selected RATED EPR MODE switch is out
1 Depress WARNING CAUTION ADVISORY TEST switch on FE/SO LIGHT panel.
• Does light come on?
NO
3 Reject lamp in RATED EPR MODE switch
YES
2 Perform ILCB BITE test for card 1A30 (33-17-00).
• Is card OK?
NO
4 Replace card 1A30 (33-17-04)
YES
5 Replace mode switch (20-33-01).
• If fault persists, replace RATED EPR MODE control panel (77-13-03).
• If fault persists, check aircraft wiring (WDM 77-13-01)

PREREQUISITES
Electrical Pwr (24-41-00)
CB's closed:
CB-1 F19, G27, H3, H4, and H5
CB-2 D15, D19, D20, D22, E20, H6, and L8
CB-3 R12

EM1-43800-77-117

CR Rated EPR Mode Switch Not Lighted
CR Figure 106

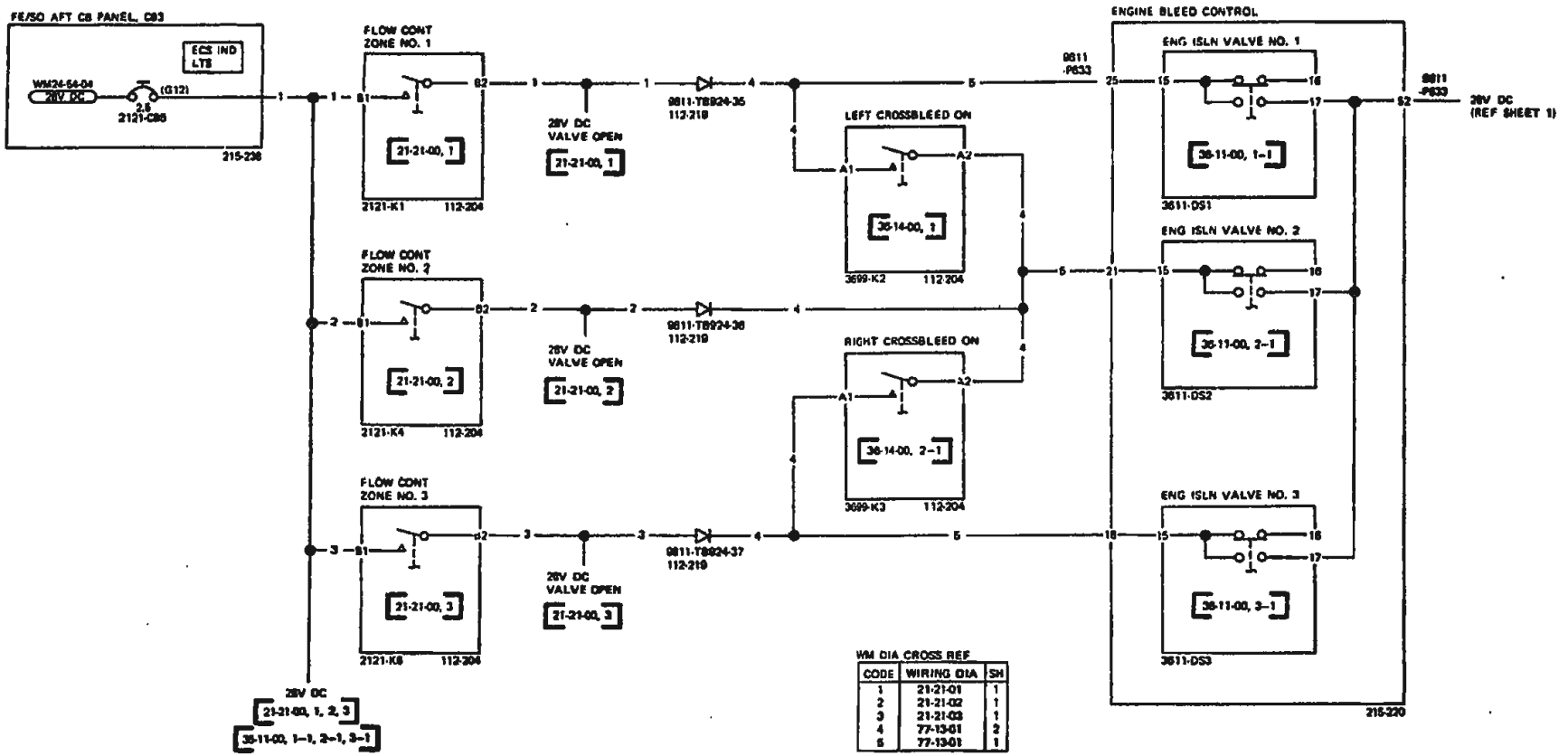
EFFECTIVITY: ALL - MAGNETIC WHEEL TYPE



CR
CR

Rated EPR Circuits
SCHEM 1 (Sheet 1)

EFFECTIVITY: ALL - MAGNETIC WHEEL TYPE



WM DIA CROSS REF

CODE	WIRING DIA	SH
1	21-21-01	1
2	21-21-02	1
3	21-21-03	1
4	77-13-01	2
5	77-13-01	1

NOTE

1 [77-10-00, 1] • CROSS REF. TO SCHEM IN DIFFERENT ATA NO.

2 ⟵4⟶ • NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.

3 ALL REF. DESIGNATIONS ARE PREFIXED WITH 7713 UNLESS OTHERWISE SPECIFIED

EM1-0004-77-100

C
C

Rated EPR Circuits
SCHEM 1 (Sheet 2)

R
R

EFFECTIVITY: ALL - MAGNETIC WHEEL TYPE

001B

CR RATED ENGINE PRESSURE RATIO COMPUTER SYSTEM
CR FAULT ISOLATION

CR 1. General

CR The fault isolation diagrams in this section can be used for fault isolation any time a fault is reported or suspected. Before fault isolation is started, the PREREQUISITES listed on the diagram must be fulfilled.

CR If the flight crew reports a trouble using a FIRM Fault Code number, the number can be found in the FIRM Fault Code Cross Reference Table in the Chapter 77 INDEX.

CR The FIRM Fault Code Cross Reference Table includes the flight report (fault symptoms) and the exact Section, Figure, Sheet, and Block number where fault isolation should begin. (Refer to the L-1011 Maintenance Manual Introduction for a more detailed explanation on the use of fault isolation diagrams.)

CR If a fault is reported or suspected and no FIRM Fault Code is available, the function or fault indication can be found in the table below. When a diagram is selected in this manner fault isolation is started at Block 1.

CR 2. Fault Isolation/Identification

CR Table 101 is a list of fault isolation data in this section of the manual.

CR Fault Isolation Data
CR Table 101

FIGURE	TITLE
101	Rated EPR Component Locator Index
102	Component Locator
103	Rated EPR Indication
104	Selected Mode Not Annunciated
105	Rated EPR Indicator Flags
106	Rated EPR Mode Switch Not Lighted
SCHEM 1	Rated EPR Circuits

R EFFECTIVITY: ALL - SOLID STATE TYPE

COMPONENT	QTY	AREA/ACCESS	REFERENCE
COMPUTOR	1	FESC/112AB	77-13-01
INDICATOR	1	FLT STATION/PILOT CENTER INST PANEL	77-13-02
CONTROL PANEL	1	FLT STATION/FE/SO LOWER PANEL	77-13-03

M1-0000-77-179

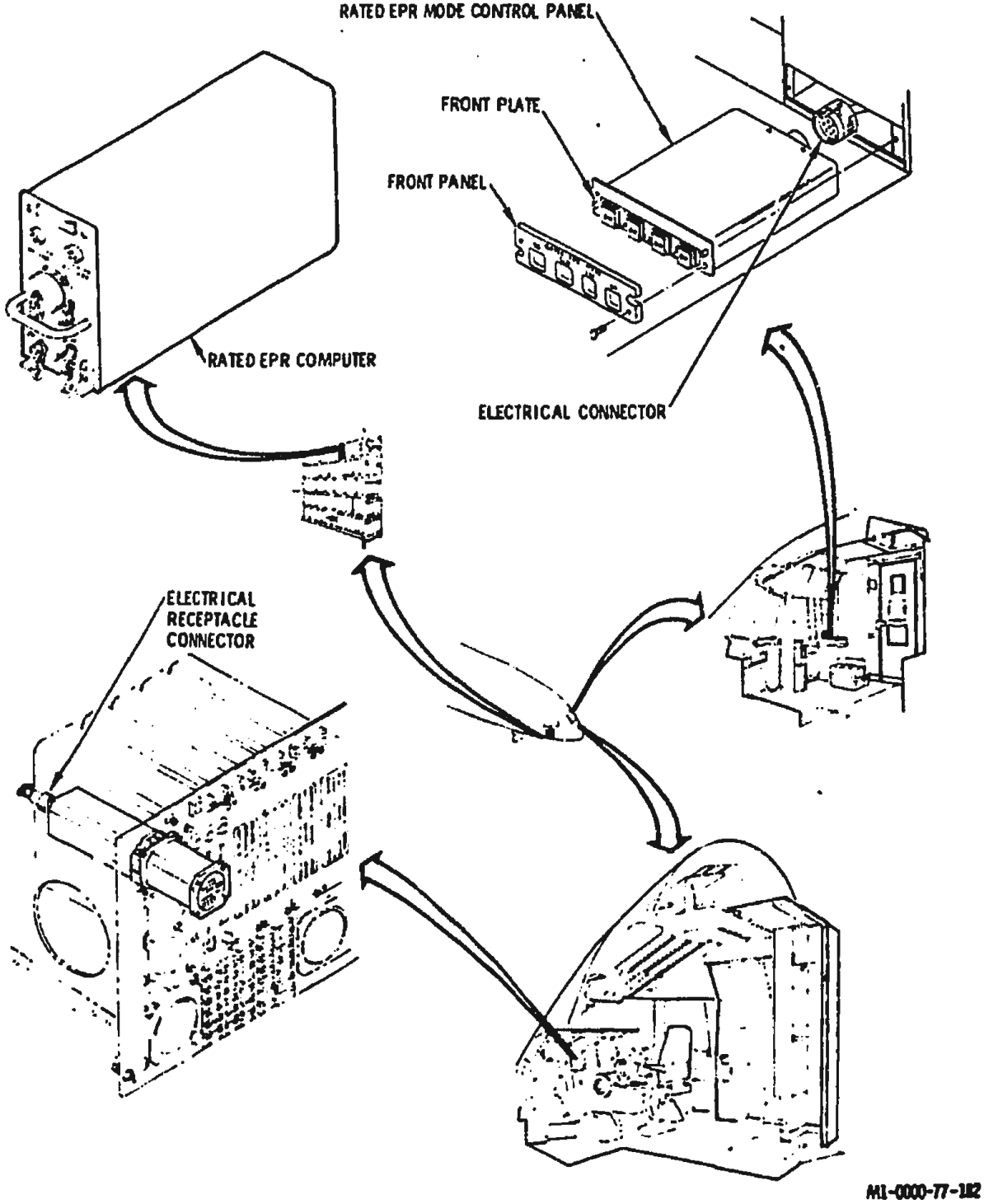
CR
CR

Rated EPR Component Locator Index
Figure 101

R
R
R

EFFECTIVITY: ALL - SOLID STATE TYPE

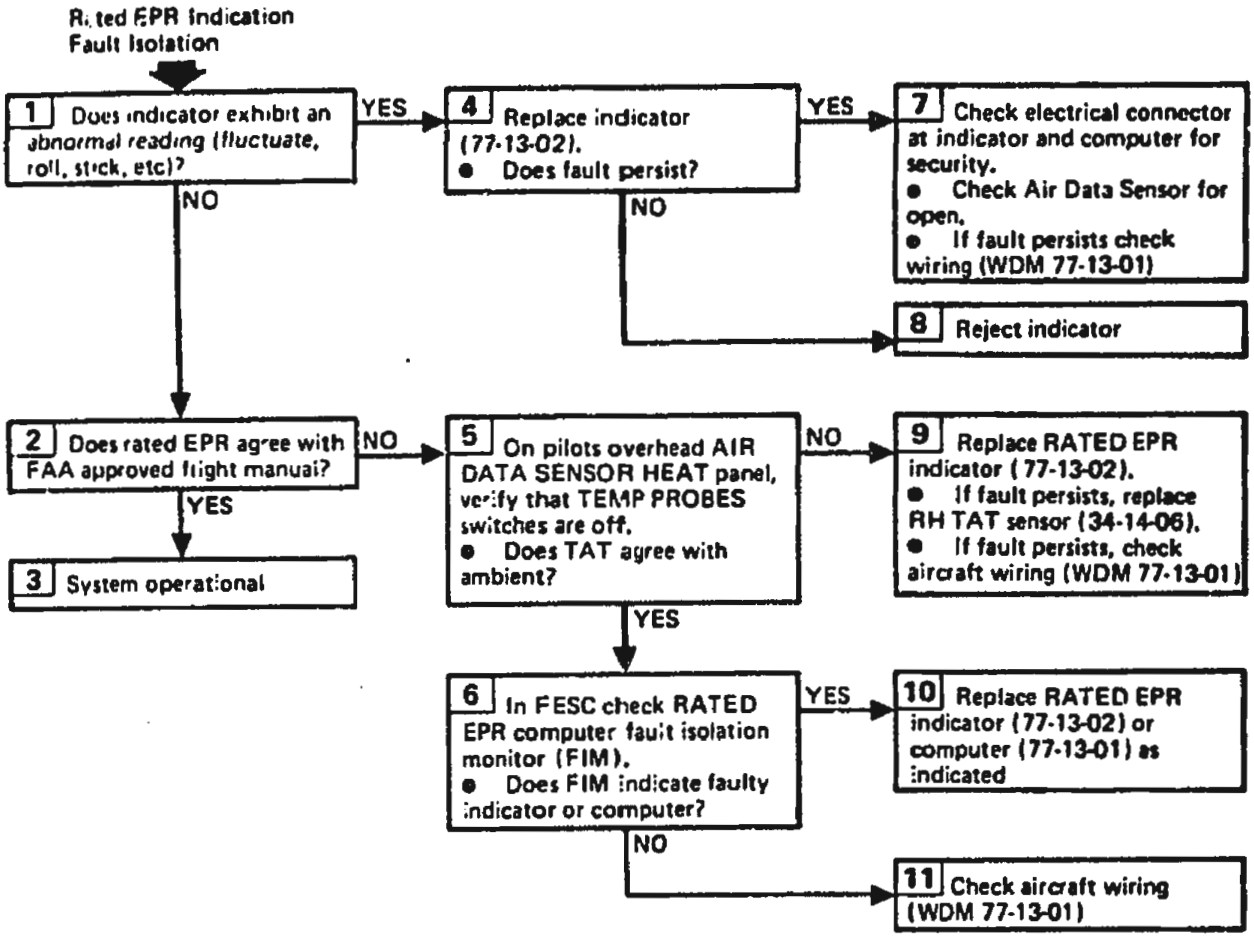
002A



CR
CR

Component Locator
Figure 102

R EFFECTIVITY: ALL - SOLID STATE TYPE
R
R
0012R

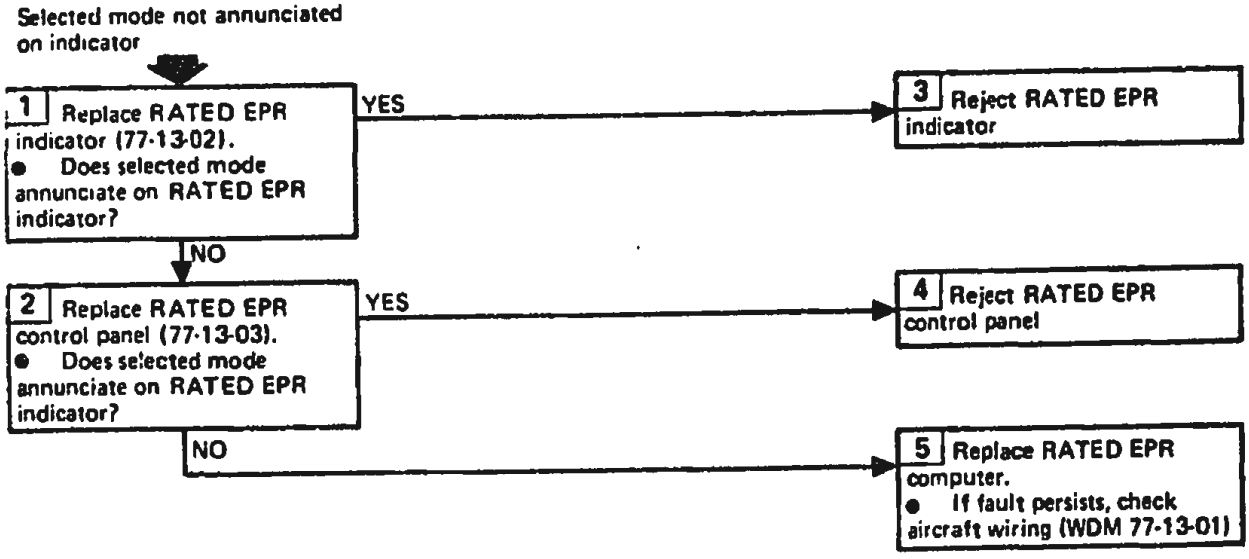

Rated EPR Indication Fault Isolation
1 Does indicator exhibit an abnormal reading (fluctuate, roll, stick, etc)?
YES
NO
4 Replace indicator (77-13-02).
• Does fault persist?
YES
NO
7 Check electrical connector at indicator and computer for security.
• Check Air Data Sensor for open.
• If fault persists check wiring (WDM 77-13-01)
8 Reject indicator
2 Does rated EPR agree with FAA approved flight manual?
NO
YES
3 System operational
5 On pilots overhead AIR DATA SENSOR HEAT panel, verify that TEMP PROBES switches are off.
• Does TAT agree with ambient?
NO
YES
9 Replace RATED EPR indicator (77-13-02).
• If fault persists, replace RH TAT sensor (34-14-06).
• If fault persists, check aircraft wiring (WDM 77-13-01)
6 In FESC check RATED EPR computer fault isolation monitor (FIM).
• Does FIM indicate faulty indicator or computer?
YES
NO
10 Replace RATED EPR indicator (77-13-02) or computer (77-13-01) as indicated
11 Check aircraft wiring (WDM 77-13-01)

PREREQUISITES
Electrical Pwr (24-41-00)
CB's closed:
CB1-F19, G27, H3, H4, and H5
CB2-D15, D19, D20, D22, E20, H6, and L8
CB3-R12

M1-27603-77-114

CR
CR
Rated EPR Indication
Figure 103

R EFFECTIVITY: ALL - SOLID STATE TYPE
R
R
002R

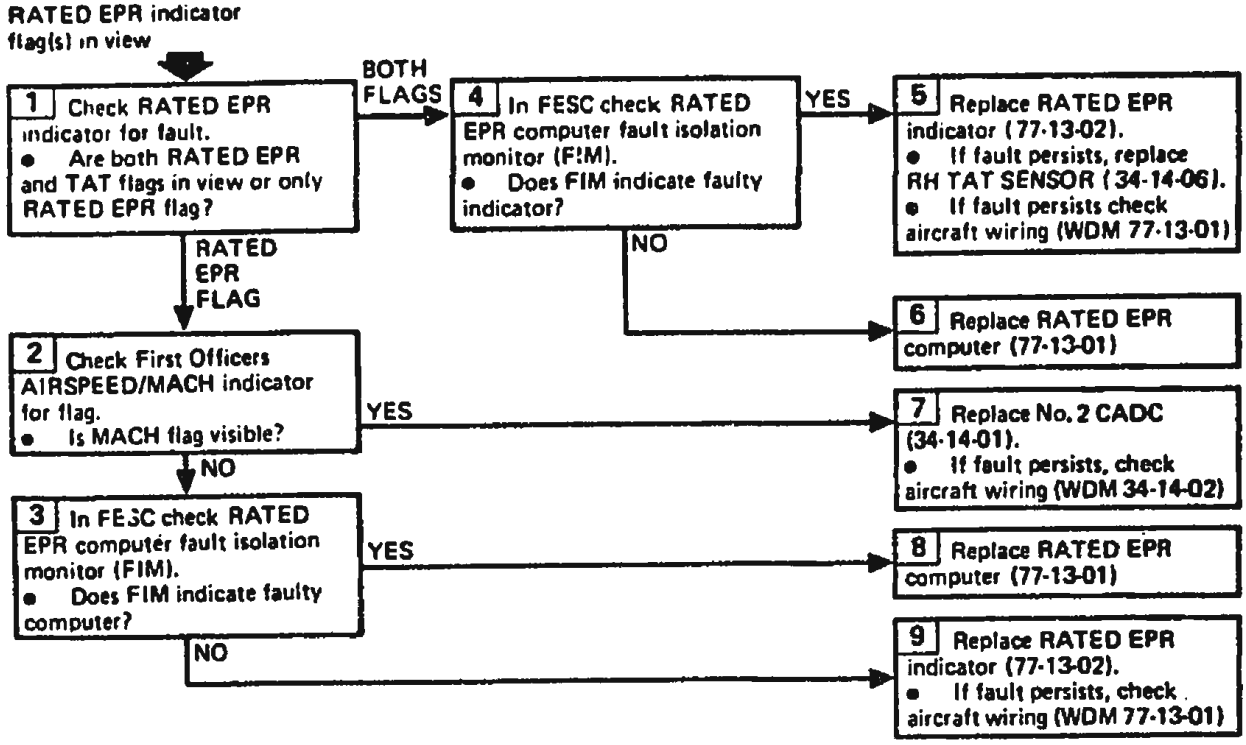

Selected mode not annunciated on indicator
1 Replace RATED EPR indicator (77-13-02).
● Does selected mode annunciate on RATED EPR indicator?
YES
3 Reject RATED EPR indicator
NO
2 Replace RATED EPR control panel (77-13-03).
● Does selected mode annunciate on RATED EPR indicator?
YES
4 Reject RATED EPR control panel
NO
5 Replace RATED EPR computer.
● If fault persists, check aircraft wiring (WDM 77-13-01)

PREREQUISITES
Electrical Pwr (24-41-00)
CB's closed:
CB-1 F19, G27, H3, H4, and H5
CB-2 D15, D19, D20, D22, E20, H6, and L8
CB-3 R12

EM1-43601-77-115

CR
CR
Selected Mode Not Annunciated
Figure 104

R EFFECTIVITY: ALL - SOLID STATE TYPE
R
R
002R

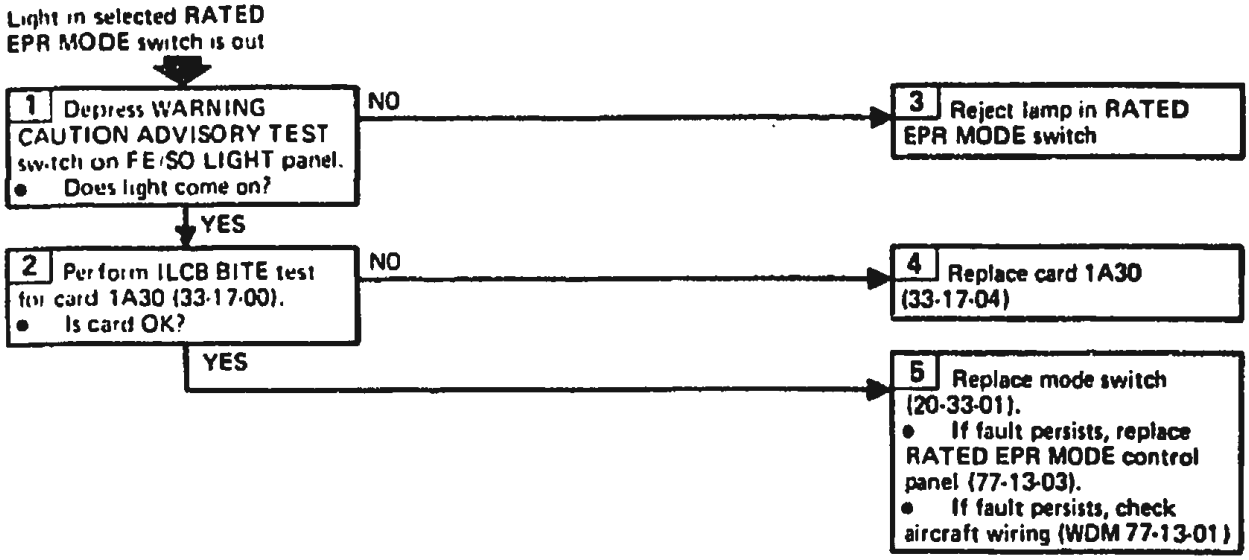

RATED EPR indicator flag(s) in view
1 Check RATED EPR indicator for fault.
• Are both RATED EPR and TAT flags in view or only RATED EPR flag?
BOTH FLAGS
RATED EPR FLAG
4 In FESC check RATED EPR computer fault isolation monitor (FIM).
• Does FIM indicate faulty indicator?
YES
NO
5 Replace RATED EPR indicator (77-13-02).
• If fault persists, replace RH TAT SENSOR (34-14-06).
• If fault persists check aircraft wiring (WDM 77-13-01)
6 Replace RATED EPR computer (77-13-01)
2 Check First Officers AIRSPEED/MACH indicator for flag.
• Is MACH flag visible?
YES
NO
7 Replace No. 2 CADC (34-14-01).
• If fault persists, check aircraft wiring (WDM 34-14-02)
3 In FESC check RATED EPR computer fault isolation monitor (FIM).
• Does FIM indicate faulty computer?
YES
NO
8 Replace RATED EPR computer (77-13-01)
9 Replace RATED EPR indicator (77-13-02).
• If fault persists, check aircraft wiring (WDM 77-13-01)

PREREQUISITES
Electrical Pwr (24-41-00)
CB's closed:
CB1-G27
·F19
CB2-H6
·E20
·L8
CB3-R12

EM1-43801-77-116

CR
CR
Rated EPR Indicator Flags
Figure 105

R EFFECTIVITY: ALL - SOLID STATE TYPE
R
R
0028

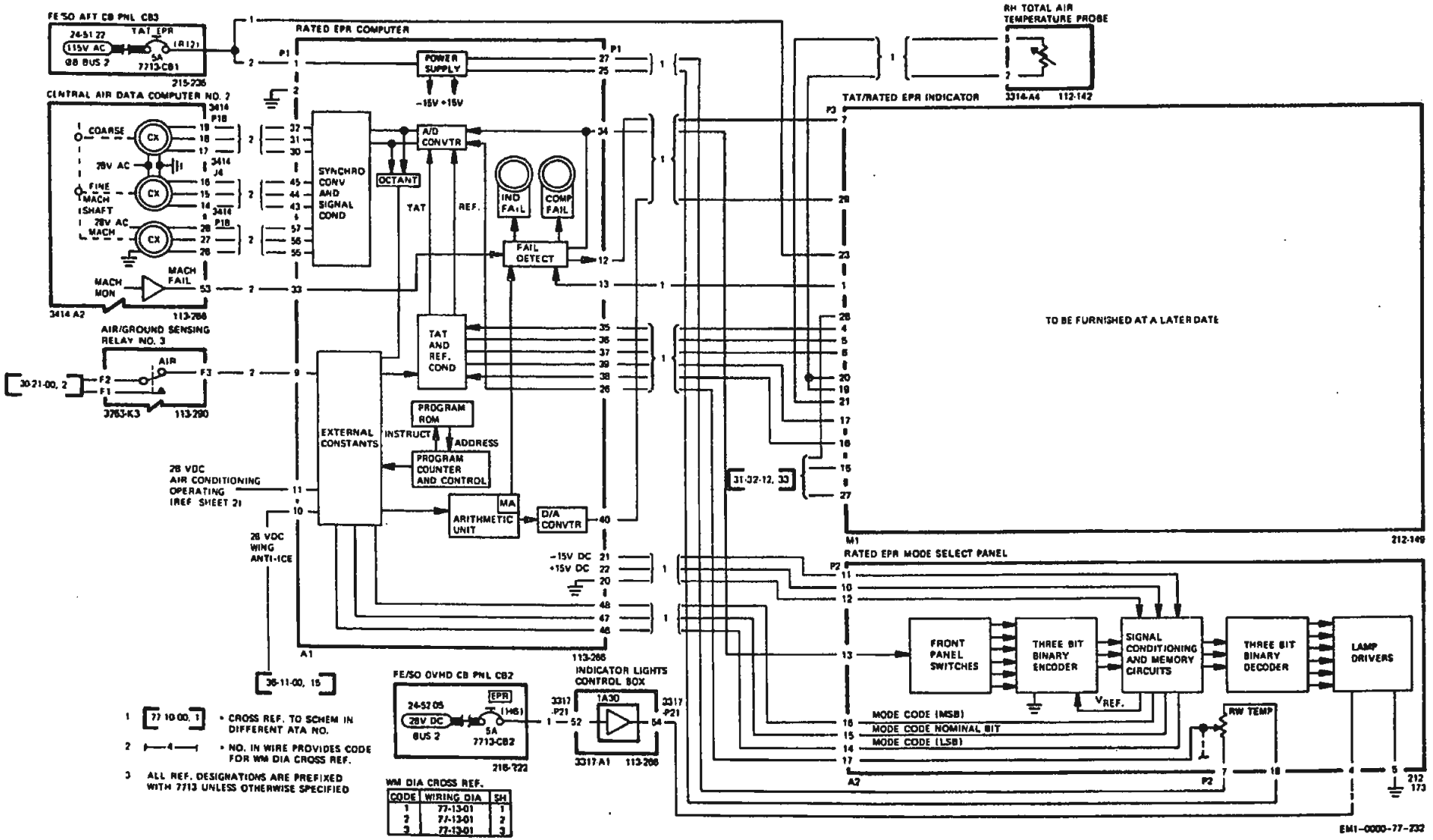

Light in selected RATED EPR MODE switch is out
1 Depress WARNING CAUTION ADVISORY TEST switch on FE/SO LIGHT panel.
• Does light come on?
NO
3 Reject lamp in RATED EPR MODE switch
YES
2 Perform ILCB BITE test for card 1A30 (33-17-00).
• Is card OK?
NO
4 Replace card 1A30 (33-17-04)
YES
5 Replace mode switch (20-33-01).
• If fault persists, replace RATED EPR MODE control panel (77-13-03).
• If fault persists, check aircraft wiring (WDM 77-13-01)

PREREQUISITES
Electrical Pwr (24-41-00)
CB's closed:
CB-1 F19, G27, H3, H4, and H5
CB-2 D15, D19, D20, D22, E20, H6, and L8
CB-3 R12

EM1-43600-77-117

CR
CR
Rated EPR Mode Switch Not Lighted
Figure 106

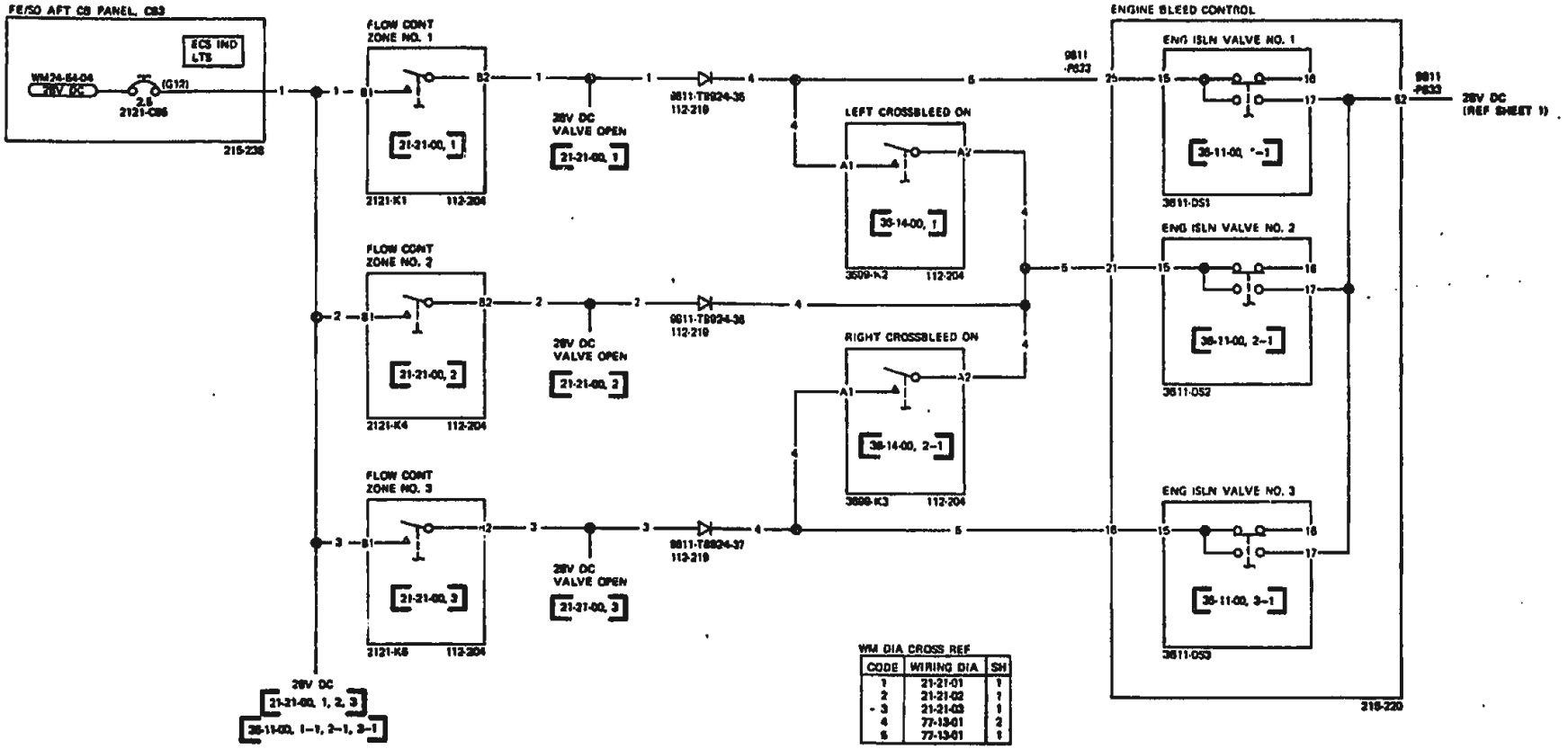
R EFFECTIVITY: ALL - SOLID STATE TYPE
R
R
0002A



CR
CR

Rated EPR Circuits
SCHEM 1 (Sheet 1)

R EFFECTIVITY: ALL - SOLID STATE TYPE
R
R
0028



WM DIA CROSS REF

CODE	WIRING DIA	SH
1	21-21-01	1
2	21-21-02	1
3	21-21-03	1
4	77-13-01	2
5	77-13-01	1

NOTE

1. [77-10-00, 1] = CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
2. ⊢— 4 —⊣ = NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
3. ALL REF. DESIGNATIONS ARE PREFIXED WITH 7713 UNLESS OTHERWISE SPECIFIED

EM1-0004-77-1B0

CR Rated EPR Circuits
CR SCHEM 1 (Sheet 2)

EFFECTIVITY: ALL - SOLID STATE TYPE

CR RATED ENGINE PRESSURE RATIO SYSTEM - ADJUSTMENT AND TEST

CR 1. General

CR This procedure includes a computer quick check, panel and
CR indicator quick check, and a system test.

CR The quick checks are performed after removal and installation to
CR verify satisfactory component operation. The system test is
CR performed to verify operation of the entire system.

CR Preparation and completion paragraphs are included to be
CR performed with quick checks and the system test. Before
CR performing the system test using the Milhard Engineering Air
CR Data Tester (Ref. Fig. 501), a functional test of the equipment
CR must be performed (Ref. 34-13-00).

CR 2. Equipment and Materials

CR Air Data Tester, Milhard Engineering Co., P/N 127, or equivalent

CR Pitot/Static Adapter Kit, Milhard Engineering Co., P/N 127-1011,
CR or equivalent

CR Thermometer, ± 1° C accuracy

CR 3. Referenced Procedures

CR	21-41-00	External Power/Ground Service System - Maintenance Practices
CR	34-13-00	Pitot Static System - Adjustment and Test
CR	34-14-00	Central Air Data Computer System - Adjustment and Test
CR	36-13-00	High Pressure Ground Air System - Maintenance Practices

CR 4. Adjustment/Test

CR A. Preparation

CR (1) On pilots overhead circuit breaker panel CB1, zone 210,
CR verify that circuit breakers PACK FLOW CONTROL 1 (H3),
CR 2 (H4), and 3 (H5), AIR DATA CMPTR (G27), VERT SP IND

CR (E21), ALTM (F22), IAS/MACH (F19), and CROSSBLEED
CR VALVES L (G17) and R (G18) are closed.

CR On Flight Engineer/Second Officers overhead circuit
CR breaker panel CB2, zone 215, open and tag circuit
CR breakers ANTI-ICE PITOT HEAT - F/O PRIM (E17) and F/O
CR SEC (E16). Verify that circuit breakers ANTI-ICE ENG 1
CR (D15), ENG 2 (D19), and ENG 3 (D20), WING ANTI-ICE CONT
CR (D22), and MLG GND SENSE (L8) are closed.

CR On Flight Engineer/Second Officers aft circuit breaker
CR panel CB3, zone 215, verify that circuit breakers
CR TAT/EPR (R12) and ECS IND LT (G12) are closed.

CR (2) Turn on electrical power (Ref. 24-41-00).

CR WARNING: ENSURE THAT TEMPERATURE PROBE NO. 2 HEATER HAS
CR BEEN OFF FOR AT LEAST 15 MINUTES.

CR (3) On AIR DATA SENSOR HEAT panel, zone 210, verify that
CR PITOT - CAPT and F/O switches are off.

CR (4) Verify that TAT and RATED EPR flags on EPR indicator,
CR zone 210, are out of view.

CR (5) Verify that NO. 1, NO. 2, and NO. 3 PACK FLOW CONTROL
CR switchlights on ENGINE BLEED CONTROL panel, zone 215,
CR are off.

CR (6) Verify that all switches on ENGINE ANTI-ICE and WING
CR ANTI-ICE control panels, zone 210, are off.

CR (7) Connect external high pressure air supply to the center
CR crossbleed manifold ground connection valve (Ref.
CR 36-13-00).

CR (8) Shield temperature probe No. 2 from direct wind and
CR sunlight. Allow temperature to stabilize prior to
CR taking test data.

CR (9) Verify that TAT on RATED EPR indicator agrees with
CR outside static temperature reading on thermometer (± 2
CR degrees C).

CR B. Computer Quick Check

CR NOTE: Bleed Air Manifold must be pressurized using external
CR high pressure source. Ensure all three ENG ISLN
CR VALVE switchlights are unlatched.

CR (1) On pilots center instrument panel, zone 210, note
CR temperature from TAT indicator.

CR (2) Obtain and note airport altitude.

CR (3) Using noted temperature and altitude, read EPR chart
CR (from FAA Approved Flight Manual) and note reading for
CR TO mode (Ref. Figure 504).

CR (4) On Flight Engineer/Second Officers lower panel, zone
CR 215, depress rated EPR mode TO switchlight.

CR (5) RATED EPR on indicator must read (±) .007 of noted
CR chart reading. Note reading.

CR (6) Verify that switchlight indicates ON and that
CR applicable mode is in view on the RATED EPR indicator.

CR (7) Depress left CROSSBLEED valve switchlight. Verify that
CR flow bar is on.

CR (8) Depress NO. 2 PACK FLOW CONTROL valve switchlight to
CR ON. Verify that flow bar is on.

CR (9) On the ENGINE BLEED control panel, zone 215, depress
CR the aft fuselage ISLN VALVE and NO. 2 ENG ISLN VALVE
CR switchlights to ON. Verify that flow bar is on.

CR (10) RATED EPR on indicator must read .007 to .011 from
CR reading noted in Step (5). Note reading.

CR (11) On pilots overhead panel, depress ENGINE ANTI-ICE NO. 2
CR switchlight. Verify that there is no change in the
CR RATED EPR indication.

CR (12) On Flight Engineer/Second Officers overhead circuit
CR breaker panel CB2, open circuit breaker MLG GND SENSE
CR (L8).

CR (13) Rated EPR on indicator must decrease from reading noted
CR in Step (10). Note reading.

CR (14) On pilots overhead panel depress WING ANTI-ICE LEFT
CR MANUAL switchlight.

CR (15) Rated EPR on indicator must decrease from reading noted
CR in Step (13).

CR (16) Close MLG GND SENSE circuit breaker opened in Step
CR (12).

CR (17) Release WING ANTI-ICE LEFT MANUAL switchlight and
CR ENGINE ANTI-ICE NO. 2 switchlight to OFF.

CR (18) Depress remaining mode switchlights as each switchlight is depressed, verify that selected mode switchlight indicates ON and mode is displayed on indicator.

CR (19) Release the aft fuselage ISLN VALVE, NO. 2 ENG ISLN VALVE, NO. 2 PACK FLOW CONTROL valve, and left CROSSBLEED VALVE switchlights on the ENGINE BLEED CONTROL panel to OFF.

CR C. Panel or Indicator Quick Check

CR (1) On pilots center instrument panel, zone 210, note temperature from TAT indicator.

CR (2) Obtain and note airport altitude.

CR (3) Using noted temperature and altitude, read EPR chart in FAA Approved Flight Manual and note reading for TO mode.

CR (4) On Flight Engineer/Second Officers lower panel, zone 215, depress rated EPR mode TO switchlight.

CR (5) RATED EPR on indicator must read (±) .007 of noted chart reading. Note indicator reading.

CR (6) Verify that switchlight indicates ON and that applicable mode is displayed on the RATED EPR indicator.

CR (7) Depress remaining mode switchlights. As each switchlight is depressed, verify that selected mode switchlight indicates ON and mode is displayed on indicator.

CR D. System Test

CR CAUTION: DO NOT USE AIR DATA TESTER TO PERFORM TEST UNLESS FUNCTIONAL TEST (REF. 34-13-00) HAS BEEN SATISFACTORILY ACCOMPLISHED.

CR (1) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, verify that ANTI-ICE PITOT HEAT, F/O PRIM (E17) and F/O SEC (E16) circuit breakers are open and tagged.

CR (2) Connect air data tester to aircraft (Ref. Fig. 502) and verify that all tester valves are closed and switches are off.

CR CAUTION: NO LUBRICANT OTHER THAN CLEAN WATER IS TO BE USED WHEN INSTALLING ANY PITOT-STATIC TUBE ADAPTER.

CR (3) Install Pitot Static Adpater, Part No. PSS44600-4-5-5, or equivalent, on First Officers primary pitot static probe at FS 222 R, WL 181 (upper-forward probe) and install Pitot Static Adapter Plug, Part No. PSS44601, or equivalent, on First Officers secondary pitot static probe at FS 230L, WL 167 (lower-aft probe). Use only clean water as a lubricant.

NOTE: If pitot static adapters are not available, make separate connections to P4/S3 (First Officers primary pitot static probe) and seal S4 on First Officers primary pitot static probe and P3/S3/S4 on First Officers secondary pitot static probe using red tape.

CAUTION: WHEN PERFORMING TEST WITHOUT PITOT STATIC ADAPTER, PART NO. PSS44600-4-5-5, BOTH HOSES MUST BE CONNECTED TO THEIR RESPECTIVE PITOT AND STATIC PORTS ON THE SAME SYSTEM; DO NOT CROSS-CONNECT HOSES BETWEEN SYSTEMS.

CR (4) Remove caps from PITOT and STATIC fittings on air data tester front panel and connect to P4/S3 on adapter on First Officers primary pitot static probe using two 30-foot hoses in pitot static adapter kit or equivalent.

CR (5) Verify that equipment cooling system is operating as evidenced by exhaust air flow from the oval opening below the right-hand flight station windows.

CR (6) Perform self test of ADC No. 2 (Ref. 34-14-00).

CR (7) Set First Officers barometric altimeter to 29.92 IN HG.

CR (8) Set tester POWER switch to ON (Ref. Fig. 501).

CR (9) Open PITOT and STATIC LEAK TEST valves.

CR CAUTION: DO NOT EXCEED 4000 FPM CLIMB/DESCENT AT ANY TIME DURING TEST.

CR (10) Slowly open RATE OF CLIMB adjustment valve and adjust ALTITUDE REGULATOR for a readout of 2500 feet on First Officers altimeter.

CR (11) Verify that airspeed readout on First Officers AIRSPEED/MACH indicator is 60 (±5) knots.

CR (12) Perform takeoff mode check as follows:

CR (a) Depress TO switchlight on RATED EPR MODE panel to ON; verify that TO MODE on EPR indicator is in view.

CR (b) Verify that RATED EPR on EPR indicator is within limits (Ref. Fig. 503, Column 1). Note reading.

CR (c) Depress NO. 2 PACK FLOW CONTROL switchlight on ENGINE BLEED CONTROL panel to on; verify that RATED EPR on EPR indicator is within (±) .001 of reading noted in Step (b). Note reading.

CR (d) Depress NO. 2 ENG ISLN VALVE switchlight on ENGINE BLEED CONTROL PANEL to on; verify that RATED EPR on indicator is .008 to .010 less than reading noted in Step (c). Note reading.

CR (e) Depress NO. 1, 2, and 3 switchlights on ENGINE ANTI-ICE control panel to ON; verify that RATED EPR on indicator is within (±) .001 of reading noted in Step (d).

CR (f) Release NO. 2 PACK FLOW CONTROL switchlight on ENGINE BLEED CONTROL panel to OFF.

CR (g) Release NO. 2 ENG ISLN VALVE switchlight on ENGINE BLEED CONTROL panel to OFF.

CR (h) Release NO. 1, 2, and 3 switchlights on ENGINE ANTI-ICE control panel to OFF.

CR (i) Verify that RATED EPR on indicator is within limits (Ref. Fig. 503, Column 1). Note reading.

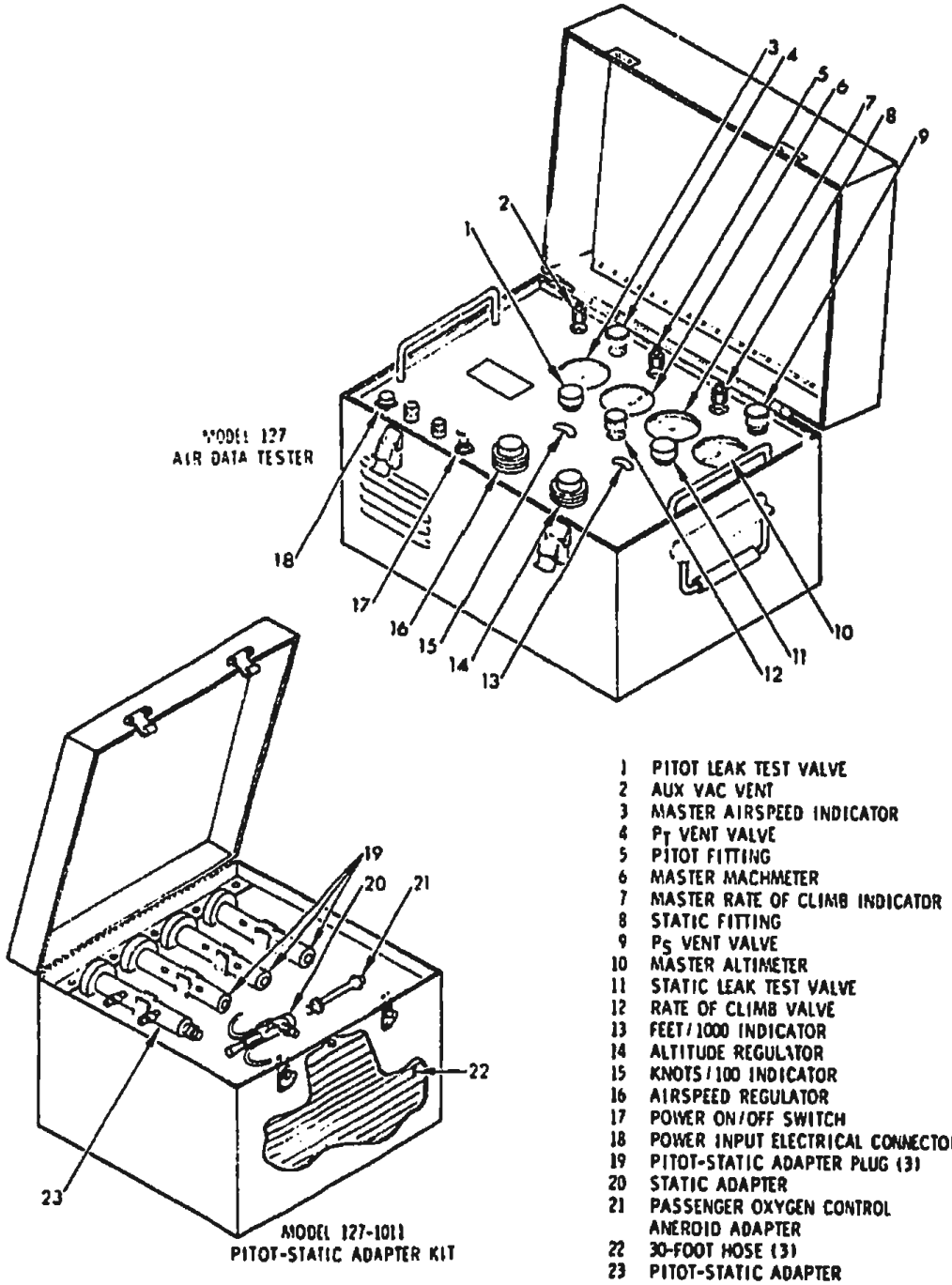
CR (j) Depress NO. 1, 2, and 3 switchlights on ENGINE ANTI-ICE control panel to ON; verify that RATED EPR on indicator is within (±) .001 of reading noted in Step (i).

CR (k) Release No. 1, 2, and 3 switchlights on ENGINE ANTI-ICE control panel to OFF.

CR (13) Perform climb (CLB) mode check as follows:

CR (a) On Flight Engineer/Second Officers aft circuit breaker panel CB2, open and tag circuit breaker MLG GND SENSE (L8).

CR (b) Depress CLB switchlight on RATED EPR MODE control panel to ON; verify that CLB mode on EPR indicator is in view.



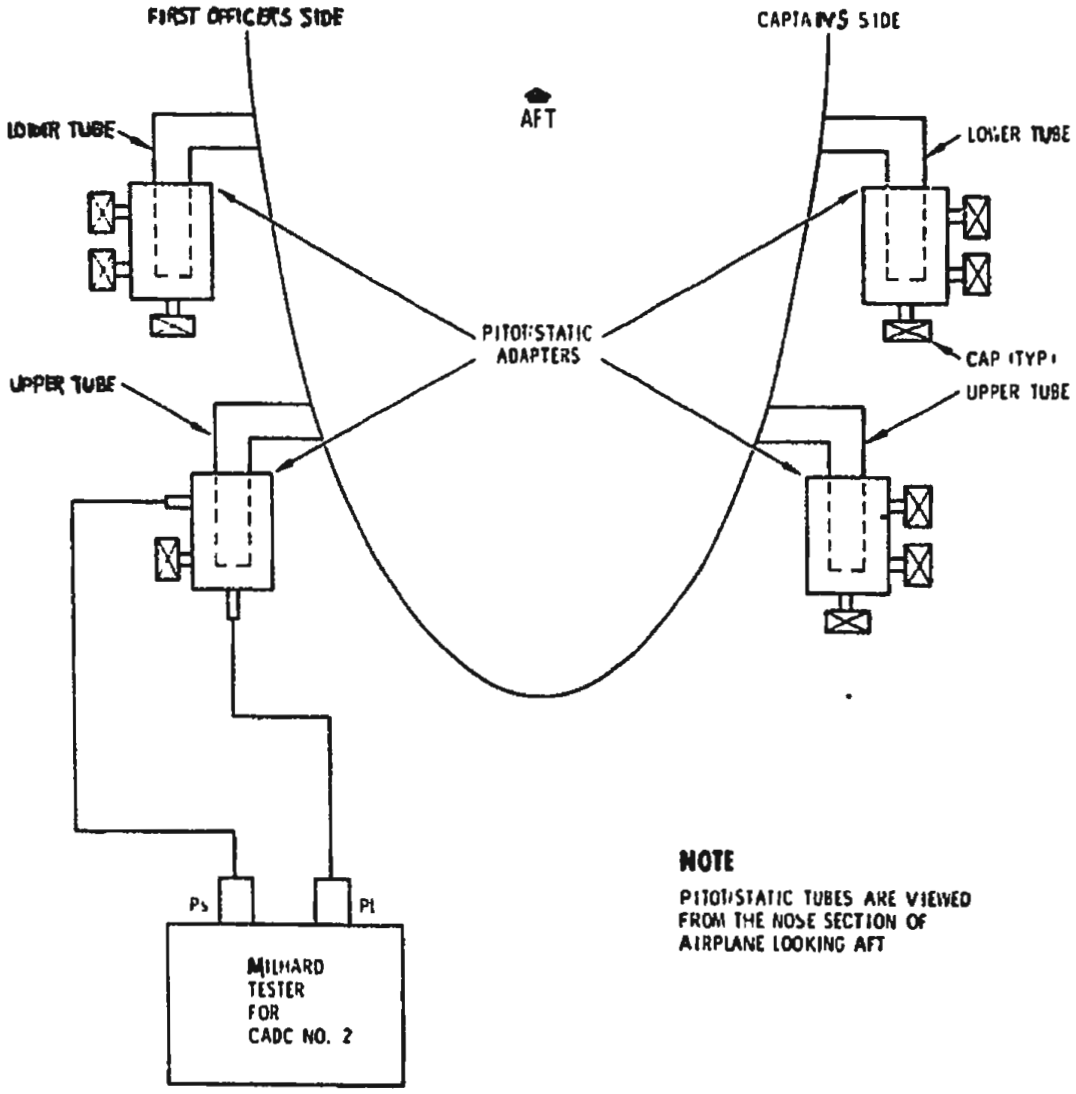
1 PITOT LEAK TEST VALVE
2 AUX VAC VENT
3 MASTER AIRSPEED INDICATOR
4 P_T VENT VALVE
5 PITOT FITTING
6 MASTER MACHMETER
7 MASTER RATE OF CLIMB INDICATOR
8 STATIC FITTING
9 P_S VENT VALVE
10 MASTER ALTIMETER
11 STATIC LEAK TEST VALVE
12 RATE OF CLIMB VALVE
13 FEET/1000 INDICATOR
14 ALTITUDE REGULATOR
15 KNOTS/100 INDICATOR
16 AIRSPEED REGULATOR
17 POWER ON/OFF SWITCH
18 POWER INPUT ELECTRICAL CONNECTOR
19 PITOT-STATIC ADAPTER PLUG (3)
20 STATIC ADAPTER
21 PASSENGER OXYGEN CONTROL ANEROID ADAPTER
22 30-FOOT HOSE (3)
23 PITOT-STATIC ADAPTER

M1-15700-77-514

CR
CR

Air Data Tester
Figure 501

EFFECTIVITY: ALL - MAGNETIC WHEEL TYPE



M1-15700-77-515

CR
CR

Test Setup
Figure 502

EFFECTIVITY: ALL - MAGNETIC WHEEL TYPE

001P

TAT	COLUMN 1		COLUMN 2		COLUMN 3		COLUMN 4		COLUMN 5	
	RATED EPR		RATED EPR		RATED EPR		RATED EPR		RATED EPR	
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
0 TO 21°C	0.546	0.554	0.466	0.476	0.465	0.475	0.558	0.568	0.500	0.510
22	0.546	0.554	0.466	0.476	0.465	0.475	0.558	0.568	0.500	0.510
23	0.546	0.554	0.466	0.476	0.465	0.475	0.555	0.565	0.500	0.510
24	0.546	0.554	0.466	0.476	0.465	0.475	0.551	0.561	0.498	0.508
25	0.542	0.550	0.462	0.472	0.461	0.471	0.546	0.556	0.494	0.504
26	0.538	0.546	0.457	0.467	0.456	0.466	0.542	0.552	0.490	0.500
27	0.534	0.542	0.452	0.462	0.452	0.462	0.537	0.547	0.485	0.495
28	0.529	0.537	0.448	0.458	0.448	0.458	0.533	0.543	0.481	0.491
29	0.524	0.532	0.444	0.454	0.444	0.454	0.528	0.538	0.476	0.486
30	0.520	0.528	0.440	0.450	0.441	0.451	0.524	0.534	0.471	0.481
31	0.515	0.523	0.436	0.446	0.436	0.446	0.519	0.529	0.467	0.477
32	0.511	0.519	0.432	0.442	0.432	0.442	0.515	0.525	0.462	0.472
33	0.506	0.514	0.428	0.438	0.427	0.437	0.510	0.520	0.458	0.468
34	0.502	0.510	0.424	0.434	0.423	0.433	0.506	0.516	0.453	0.463
35	0.498	0.506	0.419	0.429	0.419	0.429	0.502	0.512	0.449	0.459
36	0.493	0.501	0.415	0.425	0.415	0.425	0.497	0.507	0.445	0.455
37	0.489	0.497	0.411	0.421	0.410	0.420	0.493	0.503	0.441	0.451
38	0.485	0.493	0.407	0.417	0.406	0.416	0.488	0.498	0.437	0.447
39	0.480	0.488	0.402	0.412	0.402	0.412	0.484	0.494	0.433	0.443
40	0.476	0.484	0.398	0.408	0.398	0.408	0.480	0.490	0.429	0.439
41	0.472	0.480	0.394	0.404	0.394	0.404	0.475	0.485	0.425	0.435
42	0.467	0.475	0.390	0.400	0.390	0.400	0.471	0.481	0.421	0.431
43	0.463	0.471	0.386	0.396	0.386	0.396	0.467	0.477	0.417	0.427
44	0.459	0.467	0.382	0.392	0.382	0.392	0.463	0.473	0.412	0.422
45	0.454	0.462	0.378	0.388	0.378	0.388	0.458	0.468	0.408	0.418
46	0.450	0.458	0.375	0.385	0.374	0.384	0.454	0.464	0.404	0.414
47	0.446	0.454	0.371	0.381	0.370	0.380	0.450	0.460	0.400	0.410
48	0.442	0.450	0.367	0.377	0.367	0.377	0.446	0.456	0.396	0.406
49	0.438	0.446	0.364	0.374	0.363	0.373	0.442	0.452	0.392	0.402
50	0.434	0.442	0.360	0.370	0.360	0.370	0.438	0.448	0.388	0.398

EM1-15701-77-516

CR
CR

Rated EPR Limits
Figure 503

EFFECTIVITY: 001-031 WITHOUT SB78-006

001R

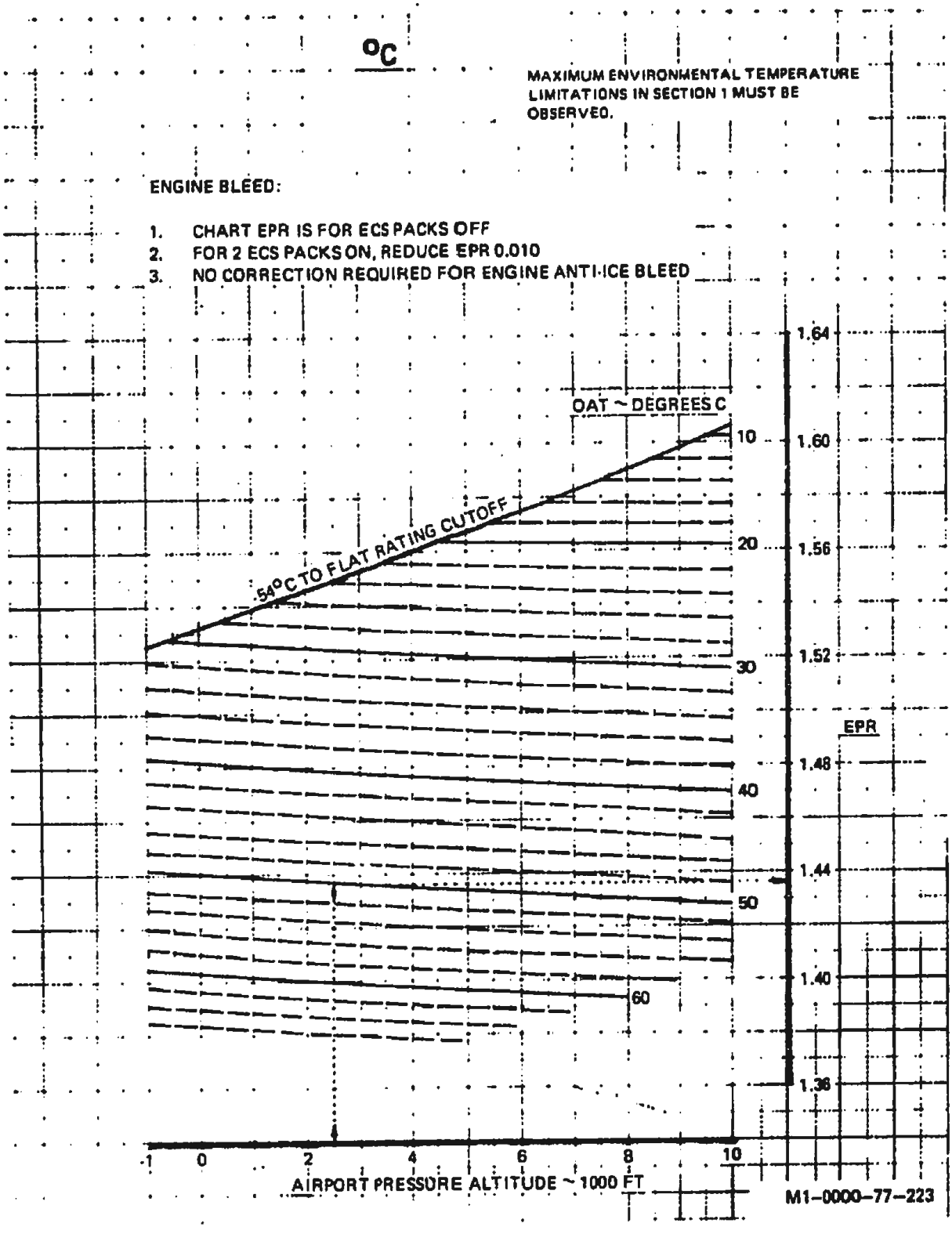
TAT	TO TAKEOFF COLUMN 1 RATED EPR MIN.	TO TAKEOFF COLUMN 1 RATED EPR MAX.	CLB CLIMB COLUMN 2 RATED EPR MIN.	CLB CLIMB COLUMN 2 RATED EPR MAX.	CRZ CRUISE COLUMN 3 RATED EPR MIN.	CRZ CRUISE COLUMN 3 RATED EPR MAX.	GA GO AROUND COLUMN 4 RATED EPR MIN.	GA GO AROUND COLUMN 4 RATED EPR MAX.
-50 TO +21°C	.546	.554	.488	.496	.457	.465	.559	.567
22	.546	.554	.488	.496	.457	.465	.559	.567
23	.546	.554	.488	.496	.457	.465	.556	.564
24	.546	.554	.488	.496	.457	.465	.552	.560
25	.542	.550	.484	.492	.452	.460	.547	.555
26	.538	.546	.479	.487	.448	.456	.543	.551
27	.534	.542	.474	.482	.444	.452	.538	.546
28	.529	.537	.470	.478	.440	.448	.534	.542
29	.524	.532	.465	.473	.436	.444	.529	.537
30	.520	.528	.461	.469	.432	.440	.525	.533
31	.515	.523	.456	.464	.428	.436	.520	.528
32	.511	.519	.452	.460	.424	.432	.516	.524
33	.506	.514	.448	.456	.419	.427	.511	.519
34	.502	.510	.444	.452	.415	.423	.507	.515
35	.498	.506	.440	.448	.411	.419	.503	.511
36	.493	.501	.436	.444	.406	.414	.498	.506
37	.489	.497	.432	.440	.402	.410	.494	.502
38	.485	.493	.428	.436	.398	.406	.489	.497
39	.480	.488	.423	.431	.394	.402	.485	.493
40	.476	.484	.419	.427	.390	.398	.481	.489
41	.472	.480	.415	.423	.386	.394	.476	.484
42	.467	.475	.411	.419	.382	.390	.472	.480
43	.463	.471	.407	.415	.378	.386	.468	.476
44	.459	.467	.402	.410	.374	.382	.464	.472
45	.454	.462	.398	.406	.370	.378	.459	.467
46	.450	.458	.394	.402	.367	.375	.455	.463
47	.446	.454	.391	.399	.363	.371	.451	.459
48	.442	.450	.387	.395	.360	.368	.447	.455
49	.438	.446	.383	.391	.356	.364	.443	.451
50	.434	.442	.379	.387	.353	.361	.439	.447

M1-0000-77-216

CR
CR

Rated EPR Limits
Figure 503

EFFECTIVITY: 001-031 WITH SB78-006 AND 032-999



CR Takeoff EPR (40 to 80 Knots)
CR Computer Quick Check
CR Figure 504

EFFECTIVITY: ALL - MAGNETIC WHEEL TYPE

CR (c) Adjust ALTITUDE REGULATOR on tester (Ref. Fig. 501) for a readout of 20,000 feet on First Officers altimeter.

CR (d) Adjust AIRSPEED REGULATOR on tester for a MACH readout of .800 on First Officers MACH AIRSPEED indicator; verify that RATED EPR on indicator is within the limits shown in (Figure 503, Column 2). Note reading.

CR (e) Depress left CROSS BLEED switchlight on ENGINE BLEED CONTROL panel to ON.

CR (f) Depress NO. 1 PACK FLOW CONTROL switchlight on ENGINE BLEED CONTROL panel to ON; verify that RATED EPR on indicator is within (±) .001 of reading noted in Step (d). Note reading.

CR (g) Depress NO. 1 ENG ISLN VALVE switchlight on ENGINE BLEED CONTROL panel to ON; verify that RATED EPR on indicator is .012 to .014 less than reading noted in Step (f).

CR (h) Depress No. 1 switchlight on ENGINE ANTI-ICE control panel to ON; verify that RATED EPR on indicator is .018 to .020 less than reading noted in Step (f).

CR (i) Depress LEFT MANUAL switchlight on WING ANTI-ICE control panel to ON.

CR (j) DEPRESS and hold TEST switch on WING ANTI-ICE control panel; verify that RATED EPR on indicator is .025 to .027 less than noted in Step (f).

CR (k) Release TEST switch and release NO. 1 switchlight on ENGINE ANTI-ICE control panel to OFF; verify that RATED EPR on indicator is .012 to .014 less than reading noted in Step (f).

CR (l) Release NO. 1 ENG ISLN VALVE switchlight on ENGINE BLEED CONTROL panel to OFF.

CR (m) Release left CROSSBLEED switchlight to OFF.

CR (n) Release NO. 1 PACK FLOW CONTROL switchlight to OFF.

CR (o) Release LEFT MANUAL switchlight on WING ANTI-ICE control panel to OFF.

CR (p) Verify that RATED EPR on indicator is within limits (Ref. Fig. 503, Column 2). Note Reading.

CR (q) Depress right CROSSBLEED switchlight to ON.

CR (r) Depress PACK FLOW CONTROL NO. 3 switchlight to ON; verify that RATED EPR on indicator is within (±) .001 of reading noted in Step(p). Note reading.

CR (s) Depress NO. 3 ENG ISLN VALVE switchlight to ON; verify that RATED EPR on indicator is .012 to .014 less than reading noted in Step(r).

CR (t) Depress No. 3 switchlight on ENGINE ANTI-ICE control panel to ON; verify that RATED EPR on indicator is .018 to .020 less than reading noted in Step(r).

CR (u) Depress RIGHT MANUAL switchlight on WING ANTI-ICE control panel to ON.

CR (v) Depress and hold TEST switch on WING ANTI-ICE control panel; verify that RATED EPR on indicator is .025 to .028 less than reading noted in (r).

CR (w) Release TEST switch to OFF.

CR (x) Release NO. 3 switchlight on ENGINE ANTI-ICE panel to OFF; verify that RATED EPR on indicator is .012 to .014 less than reading noted in Step(r).

CR (y) Release ENGINE NO. 3 ISLN VALVE switchlight on ENGINE BLEED CONTROL panel to OFF.

CR (z) Release right CROSSBLEED switchlight to OFF.

CR (aa) Release NO. 3 PACK FLOW CONTROL switchlight to OFF.

CR (ab) Release RIGHT MANUAL switchlight on WING ANTI-ICE control panel to OFF.

CR (14) Perform cruize (CRZ) mode test as follows:

CR (a) Depress CRZ switchlight on RATED EPR MODE panel; verify that CRZ MODE on RATED EPR indicator is in view and that RATED EPR on indicator is within limits (Ref. Fig. 503, Column 3). Note reading.

CR (b) Depress left CROSSBLEED switchlight on ENGINE BLEED CONTROL panel to ON.

CR (c) Depress NO. 2 PACK FLOW CONTROL switchlight to ON; verify that RATED EPR on indicator is within (±) .001 of reading noted in Step (a). Note reading.

CR (d) Depress NO. 1 ENG ISLN VALVE switchlight to ON; verify that RATED EPR on indicator is .012 to .014 less than reading noted in Step (c).

CR (e) Release NO. 1 ENG ISLN VALVE switchlight to OFF.

CR (f) Release left CROSSBLEED switchlight to OFF.

CR (g) Depress NO. 3 ISLN VALVE switchlight to ON.

CR (h) Depress right CROSSBLEED switchlight to on; verify that RATED EPR on indicator is .012 to .014 less than reading noted in Step (c).

CR (i) Release NO. 2 PACK FLOW CONTROL switchlight to OFF.

CR (j) Release NO. 3 ENG ISLN VALVE switchlight to OFF.

CR (k) Release right CROSSBLEED switchlight to OFF.

CR (15) Perform go around (GA) mode test as follows:

CR (a) Depress GA switchlight on RATED EPR MODE control panel to ON; verify that GA MODE on RATED EPR indicator is in view.

CR (b) Adjust ALTITUDE REGULATOR on tester for a readout of 5,000 feet on First Officers altimeter.

CR (c) Adjust AIRSPEED REGULATOR on tester for an AIRSPEED readout of 146 Knots on First Officer's Airspeed/Mach indicator.

CR (d) Verify that RATED EPR on indicator is within limits (Ref. Fig. 503, Column 4). Note reading.

CR (e) Depress NO. 1 switchlight on ENGINE ANTI-ICE control to ON; verify that RATED EPR on indicator is .010 to .012 less than reading noted in Step (a).

CR (f) Release NO. 1 switchlight to OFF.

CR (g) Depress LEFT MANUAL switchlight on WING ANTI-ICE control panel to ON.

CR (h) Depress and hold TEST switch on WING ANTI-ICE control panel; verify that RATED EPR on indicator is .010 to .012 less than reading noted in Step (a).

CR (i) Release TEST switch and LEFT MANUAL switchlight to OFF.

CR (j) Depress NO. 1 ENG ISLN VALVE switchlight on ENGINE BLEED CONTROL panel to ON.

CR (k) Depress left and right CROSSBLEED switchlights to ON.

CR (l) Depress NO. 3 PACK FLOW CONTROL switchlight to ON; verify that RATED EPR on indicator is .006 to .009 less than reading noted in Step (a).

CR (m) Release NO. 1 ENG ISLN VALVE switchlight to OFF.

CR (n) Release left and right CROSSBLEED switchlights to OFF.

CR (o) Release NO. 3 PACK FLOW CONTROL switchlight to OFF.

CR (p) Remove tag and close circuit breaker MLG GND SENSE (L8).

CR (q) Rotate ALTITUDE REGULATOR on tester to field elevation. Rotate AIRSPEED REGULATOR on tester to 50 knots. When ambient altitude and 50 knots airspeed are reached, close all valves and set POWER switch on tester to OFF.

CR (r) Disconnect test setup (Ref. Fig. 502) and install pitot/static tube caps as required.

CR (s) In forward electronic service center, zone 112, hold BITE test switch on flap load relieving system computer to RESET for five seconds, then return switch to RUN.

CR E. Completion

CR (1) Disconnect external high pressure air (Ref. 36-13-00).

CR (2) Remove shield from temperature probe No. 2.

CR (3) Turn off electrical power (Ref. 24-41-00).

CR CR (4) Remove tags and close circuit breakers opened in Step 4A(1).

CR RATED ENGINE PRESSURE RATIO SYSTEM - ADJUSTMENT AND TEST

CR 1. General

CR This procedure includes a computer quick check, panel and indicator quick check, and a system test.

CR The quick checks are performed after removal and installation to verify satisfactory component operation. The system test is performed to verify operation of the entire system.

CR Preparation and completion paragraphs are included to be performed with quick checks and the system test. Before performing the system test using the Milhard Engineering Air Data Tester (Ref. Fig. 501), a functional test of the equipment must be performed (Ref. 34-13-00).

CR 2. Equipment and Materials

CR Air Data Tester, Milhard Engineering Co., P/N 127, or equivalent

CR Pitot/Static Adapter Kit, Milhard Engineering Co., P/N 127-1011, or equivalent

CR Thermometer, ± 1° C accuracy

CR 3. Referenced Procedures

CR	21-41-00	External Power/Ground Service System - Maintenance Practices
CR	34-13-00	Pitot Static System - Adjustment and Test
CR	34-14-00	Central Air Data Computer System - Adjustment and Test
CR	36-13-00	High Pressure Ground Air System - Maintenance Practices

CR 4. Adjustment/Test

CR A. Preparation

CR (1) On pilots overhead circuit breaker panel CB1, zone 210, verify that circuit breakers PACK FLOW CONTROL 1 (H3), 2 (H4), and 3 (H5), AIR DATA CMPTR (G27), VERT SP IND

CR (E21), ALTM (F22), IAS/MACH (F19), and CROSSBLEED
CR VALVES L (G17) and R (G18) are closed.

CR On Flight Engineer/Second Officers overhead circuit
CR breaker panel CB2, zone 215, open and tag circuit
CR breakers ANTI-ICE PITOT HEAT - F/O PRIM (E17) and F/O
CR SEC (E16). Verify that circuit breakers ANTI-ICE ENG 1
CR (D15), ENG 2 (D19), and ENG 3 (D20), WING ANTI-ICE CONT
CR (D22), and MLG GND SENSE (L8) are closed.

CR On Flight Engineer/Second Officers aft circuit breaker
CR panel CB3, zone 215, verify that circuit breakers
CR TAT/EPR (R12) and ECS IND LT (G12) are closed.

CR (2) Turn on electrical power (Ref. 24-41-00).

CR WARNING: ENSURE THAT TEMPERATURE PROBE NO. 2 HEATER HAS
CR BEEN OFF FOR AT LEAST 15 MINUTES.

CR (3) On AIR DATA SENSOR HEAT panel, zone 210, verify that
CR PITOT - CAPT and F/O switches are off.

CR (4) Verify that TAT and RATED EPR displays on EPR
CR indicator, zone 210, are illuminated. (5) Verify that
CR NO. 1, NO. 2, and NO. 3 PACK FLOW CONTROL switchlights
CR on ENGINE BLEED CONTROL panel, zone 215, are off.

CR (6) Verify that all switches on ENGINE ANTI-ICE and WING
CR ANTI-ICE control panels, zone 210, are off.

CR (7) Connect external high pressure air supply to the center
CR crossbleed manifold ground connection valve (Ref.
CR 36-13-00).

CR (8) Shield temperature probe No. 2 from direct wind and
CR sunlight. Allow temperature to stabilize prior to
CR taking test data.

CR (9) Verify that TAT on RATED EPR indicator agrees with
CR outside static temperature reading on thermometer (± 2
CR degrees C).

CR B. Computer Quick Check

CR NOTE: Bleed Air Manifold must be pressurized using external
CR high pressure source. Ensure all three ENG ISLN
CR VALVE switchlights are unlatched.

CR (1) On pilots center instrument panel, zone 210, note
CR temperature from TAT indicator.

CR (2) Obtain and note airport altitude.

CR (3) Using noted temperature and altitude, read EPR chart in FAA Approved Flight Manual and note reading for TO mode.

CR (4) On Flight Engineer/Second Officers lower panel, zone 215, depress rated EPR mode TO switchlight.

CR (5) RATED EPR on indicator must read (±) .007 of noted chart reading. Note reading.

CR (6) Verify that switchlight indicates ON and that applicable mode is displayed on the RATED EPR indicator.

CR (7) On the ENGINE BLEED control panel, zone 215, depress the aft fuselage ISLN VALVE and NO. 2 ENG ISLN VALVE switchlights to ON. Verify that flow bar is on.

CR (8) Depress NO. 2 PACK FLOW CONTROL valve switchlight to ON. Verify that flow bar is on.

CR (9) Depress left CROSSBLEED valve switchlight. Verify that flow bar is on.

CR (10) RATED EPR on indicator must read .007 to .011 from reading noted in Step (5). Note reading.

CR (11) On pilots overhead panel, depress ENGINE ANTI-ICE NO. 2 switchlight. Verify that there is no change in the RATED EPR indication.

CR (12) On Flight Engineer/Second Officers overhead circuit breaker panel CB2, open circuit breaker MLG GND SENSE (L8).

CR (13) Rated EPR on indicator must decrease from reading noted in Step (10). Note reading.

CR (14) On pilots overhead panel depress WING ANTI-ICE LEFT MANUAL switchlight.

CR (15) Rated EPR on indicator must decrease from reading noted in Step (13).

CR (16) Close MLG GND SENSE circuit breaker opened in Step (12).

CR (17) Release WING ANTI-ICE LEFT MANUAL switchlight and ENGINE ANTI-ICE NO. 2 switchlight to OFF.

CR (18) Depress remaining mode switchlights as each switchlight CR is depressed, verify that selected mode switchlight CR indicates ON and mode is displayed on indicator.

CR (19) Release the aft fuselage ISLN VALVE, NO. 2 ENG ISLN CR VALVE, NO. 2 PACK FLOW CONTROL valve, and left CR CROSSBLEED VALVE switchlights on the ENGINE BLEED CR CONTROL panel to OFF.

CR C. Panel or Indicator Quick Check

CR (1) On the left hand side of pedestal, rotate center CR instrument panel dimming control fully counterclockwise CR (OFF).

CR (2) On pilots center instrument panel, zone 210, note CR temperature from TAT indicator.

CR (3) Obtain and note airport altitude.

CR (4) Using noted temperature and altitude, read EPR chart in CR FAA Approved Flight Manual and note reading for TO CR mode.

CR (5) On Flight Engineer/Second Officers lower panel, zone CR 215, depress rated EPR mode TO switchlight.

CR (6) RATED EPR on indicator must read (±) .007 of noted CR chart reading. Note indicator reading.

CR (7) Verify that switchlight indicates ON and that CR applicable mode is displayed on the RATED EPR CR indicator.

CR (8) Depress remaining mode switchlights. As each CR switchlight is depressed, verify that selected mode CR switchlight indicates ON and mode is displayed on CR indicator.

CR (9) On the left hand side of pedestal, rotate center CR instrument panel dimming control clockwise and confirm CR that segmented displays of indicator match light CR intensity of other instruments on panel and full CR clockwise (night-time bright) is not as bright as full CR counterclockwise (OFF-daytime bright).

CR (10) On indicator, press and hold test switch. Confirm that CR TAT display consists of 3 horizontal segments lighted CR in the left most display, the remaining 2 displays CR produce '8's. The EPR displays 888. Release test CR switch.

CR D. System Test

CR CAUTION: DO NOT USE AIR DATA TESTER TO PERFORM TEST UNLESS
CR FUNCTIONAL TEST (REF. 34-13-00) HAS BEEN
CR SATISFACTORILY ACCOMPLISHED.

CR (1) On Flight Engineer/Second Officers overhead circuit
CR breaker panel CB2, verify that ANTI-ICE PITOT HEAT, F/O
CR PRIM (E17) and F/O SEC (E16) circuit breakers are open
CR and tagged.

CR (2) Connect air data tester to aircraft (Ref. Fig. 502) and
CR verify that all tester valves are closed and switches
CR are off.

CR CAUTION: NO LUBRICANT OTHER THAN CLEAN WATER IS TO BE USED
CR WHEN INSTALLING ANY PITOT-STATIC TUBE ADAPTER.

CR (3) Install Pitot Static Adpater, Part No. PSS44600-4-5-5,
CR or equivalent, on First Officers primary pitot static
CR probe at FS 222 R, WL 181 (upper-forward probe) and
CR install Pitot Static Adapter Plug, Part No. PSS44601,
CR or equivalent, on First Officers secondary pitot static
CR probe at FS 230L, WL 167 (lower-aft probe). Use only
CR clean water as a lubricant.

CR NOTE: If pitot static adapters are not available, make
CR separate connections to P4/S3 (First Officers
CR primary pitot static probe) and seal S4 on First
CR Officers primary pitot static probe and P3/S3/S4
CR on First Officers secondary pitot static probe
CR using red tape.

CR CAUTION: WHEN PERFORMING TEST WITHOUT PITOT STATIC ADAPTER,
CR PART NO. PSS44600-4-5-5, BOTH HOSES MUST BE
CR CONNECTED TO THEIR RESPECTIVE PITOT AND STATIC
CR PORTS ON THE SAME SYSTEM; DO NOT CROSS-CONNECT
CR HOSES BETWEEN SYSTEMS.

CR (4) Remove caps from PITOT and STATIC fittings on air data
CR tester front panel and connect to P4/S3 on adapter on
CR First Officers primary pitot static probe using two
CR 30-foot hoses in pitot static adapter kit or
CR equivalent.

CR (5) Verify that equipment cooling system is operating as
CR evidenced by exhaust air flow from the oval opening
CR below the right-hand flight station windows.

CR (6) Perform self test of ADC No. 2 (Ref. 34-14-00).

CR (7) Set First Officers barometric altimeter to 29.92 IN HG.

CR (8) Set tester POWER switch to ON (Ref. Fig. 501).

CR (9) Open PITOT and STATIC LEAK TEST valves.

CR CAUTION: DO NOT EXCEED 4000 FPM CLIMB/DESCENT AT ANY TIME
CR DURING TEST.

CR (10) Slowly open RATE OF CLIMB adjustment valve and adjust
CR ALTITUDE REGULATOR for a readout of 2500 feet on First
CR Officers altimeter.

CR (11) Verify that airspeed readout on First Officers
CR AIRSPEED/MACH indicator is 60 (±5) knots.

CR (12) Perform takeoff mode check as follows:

CR (a) Depress TO switchlight on RATED EPR MODE panel to
CR ON; verify that TO MODE on EPR indicator is
CR displayed.

CR (b) Verify that RATED EPR on EPR indicator is within
CR limits (Ref. Fig. 503, Column 1). Note reading.

CR (c) Depress NO. 2 PACK FLOW CONTROL switchlight on
CR ENGINE BLEED CONTROL panel to on; verify that
CR RATED EPR on EPR indicator is within (±) .001 of
CR reading noted in Step (b). Note reading.

CR (d) Depress NO. 2 ENG ISLN VALVE switchlight on ENGINE
CR BLEED CONTROL PANEL to on; verify that RATED EPR
CR on indicator is .008 to .010 less than reading
CR noted in Step (c). Note reading.

CR (e) Depress NO. 1, 2, and 3 switchlights on ENGINE
CR ANTI-ICE control panel to ON; verify that RATED
CR EPR on indicator is within (±) .001 of reading
CR noted in Step (d).

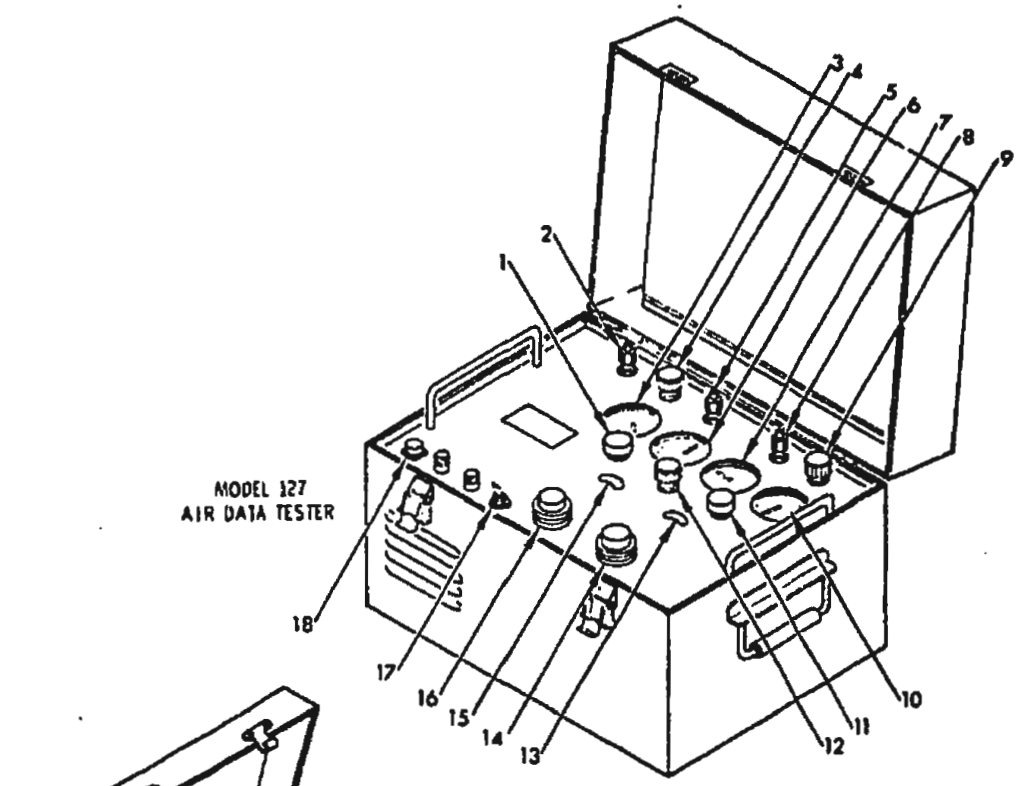
CR (f) Release NO. 2 PACK FLOW CONTROL switchlight on
CR ENGINE BLEED CONTROL panel to OFF.

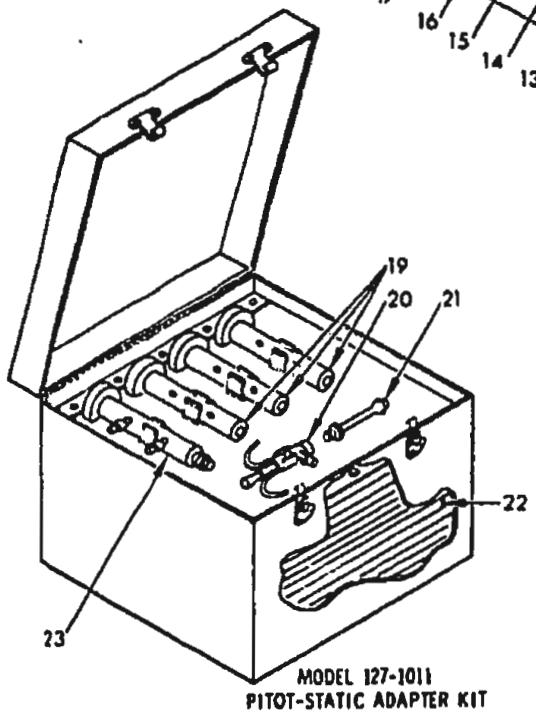
CR (g) Release NO. 2 ENG ISLN VALVE switchlight on ENGINE
CR BLEED CONTROL panel to OFF.

CR (h) Release NO. 1, 2, and 3 switchlights on ENGINE
CR ANTI-ICE control panel to OFF.

CR (i) Verify that RATED EPR on indicator is within
CR limits (Ref. Fig. 503, Column 1). Note reading.

CR (j) Depress NO. 1, 2, and 3 switchlights on ENGINE
CR ANTI-ICE control panel to ON; verify that RATED





MODEL 127-1011
PITOT-STATIC ADAPTER KIT

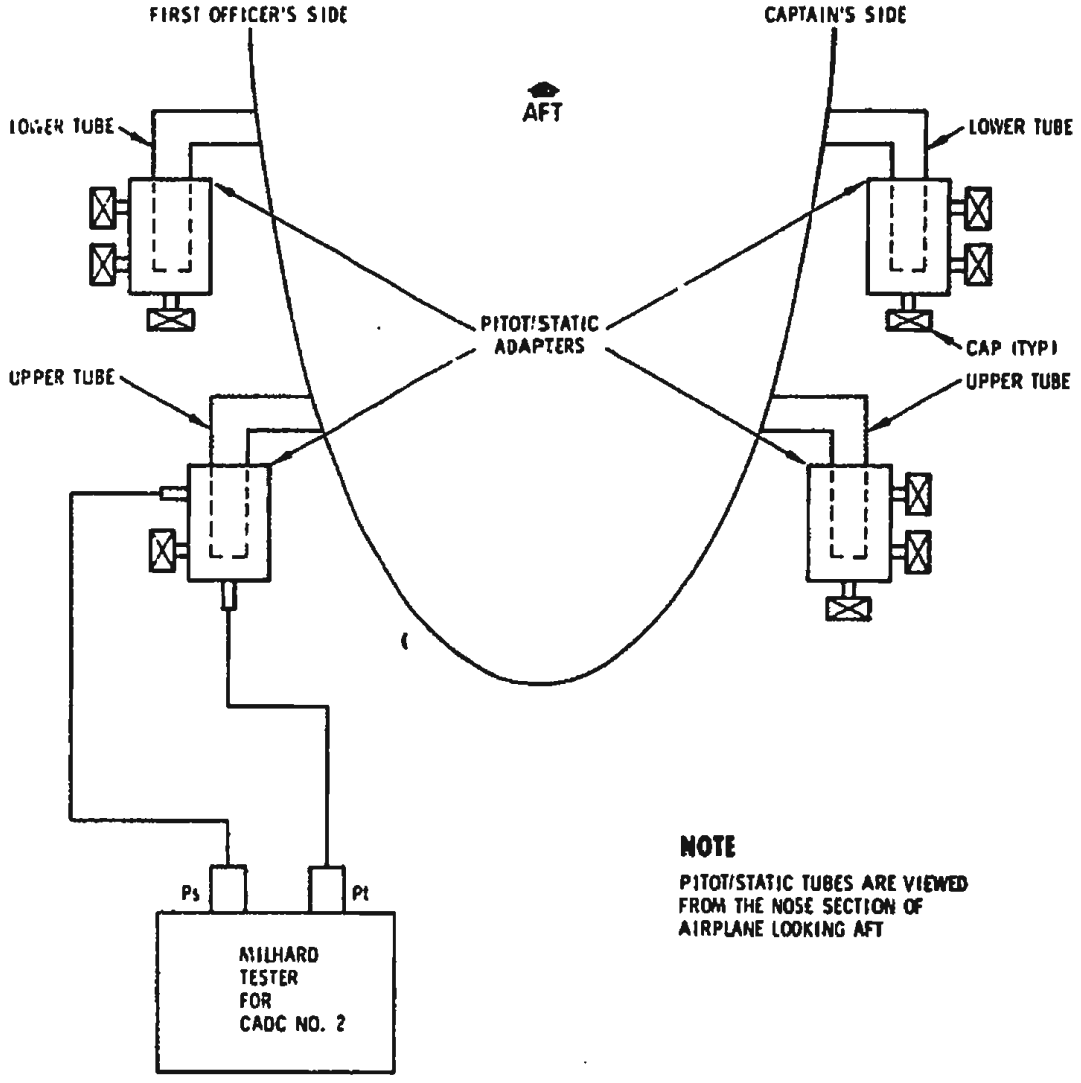
1 PITOT LEAK TEST VALVE
2 AUX VAC VENT
3 MASTER AIRSPEED INDICATOR
4 P_T VENT VALVE
5 PITOT FITTING
6 MASTER MACHMETER
7 MASTER RATE OF CLIMB INDICATOR
8 STATIC FITTING
9 P_S VENT VALVE
10 MASTER ALTIMETER
11 STATIC LEAK TEST VALVE
12 RATE OF CLIMB VALVE
13 FEET/1000 INDICATOR
14 ALTITUDE REGULATOR
15 KNOTS/100 INDICATOR
16 AIRSPEED REGULATOR
17 POWER ON/OFF SWITCH
18 POWER INPUT ELECTRICAL CONNECTOR
19 PITOT-STATIC ADAPTER PLUG (3)
20 STATIC ADAPTER
21 PASSENGER OXYGEN CONTROL ANEROID ADAPTER
22 30-FOOT HOSE (3)
23 PITOT-STATIC ADAPTER

MI-15700-77-514

CR
CR

Air Data Tester
Figure 501

R EFFECTIVITY: ALL - SOLID STATE TYPE
R
R
003F



NOTE

PITOT/STATIC TUBES ARE VIEWED FROM THE NOSE SECTION OF AIRPLANE LOOKING AFT

M1-15700-77-515

CR
CR

Test Setup
Figure 502

R EFFECTIVITY: ALL - SOLID STATE TYPE
R
R
0103R

CR EPR on indicator is within (±) .001 of reading
CR noted in Step (i).

CR (k) Release No. 1, 2, and 3 switchlights on ENGINE
CR ANTI-ICE control panel to OFF.

CR (13) Perform climb (CLB) mode check as follows:

CR (a) On Flight Engineer/Second Officers aft circuit
CR breaker panel CB2, open and tag circuit breaker
CR MLG GND SENSE (L8).

CR (b) Depress CLB switchlight on RATED EPR MODE control
CR panel to ON; verify that CLB mode on EPR indicator
CR is displayed.

CR (c) Adjust ALTITUDE REGULATOR on tester (Ref. Fig.
CR 501) for a readout of 20,000 feet on First
CR Officers altimeter.

CR (d) Adjust AIRSPEED REGULATOR on tester for a MACH
CR readout of .800 on First Officers MACH AIRSPEED
CR indicator; verify that RATED EPR on indicator is
CR within the limits shown in (Figure 503, Column 2).
CR Note reading.

CR (e) Depress left CROSS BLEED switchlight on ENGINE
CR BLEED CONTROL panel to ON.

CR (f) Depress NO. 1 PACK FLOW CONTROL switchlight on
CR ENGINE BLEED CONTROL panel to ON; verify that
CR RATED EPR on indicator is within (±) .001 of
CR reading noted in Step (d). Note reading.

CR (g) Depress NO. 1 ENG ISLN VALVE switchlight on ENGINE
CR BLEED CONTROL panel to ON; verify that RATED EPR
CR on indicator is .012 to .014 less than reading
CR noted in Step (f).

CR (h) Depress No. 1 switchlight on ENGINE ANTI-ICE
CR control panel to ON; verify that RATED EPR on
CR indicator is .018 to .020 less than reading noted
CR in Step (f).

CR (i) Depress LEFT MANUAL switchlight on WING ANTI-ICE
CR control panel to ON.

CR (j) DEPRESS and hold TEST switch on WING ANTI-ICE
CR control panel; verify that RATED EPR on indicator
CR is .025 to .027 less than noted in Step (f).

TAT	COLUMN 1 RATED EPR MIN.	COLUMN 1 RATED EPR MAX.	COLUMN 2 RATED EPR MIN.	COLUMN 2 RATED EPR MAX.	COLUMN 3 RATED EPR MIN.	COLUMN 3 RATED EPR MAX.	COLUMN 4 RATED EPR MIN.	COLUMN 4 RATED EPR MAX.	COLUMN 5 RATED EPR MIN.	COLUMN 5 RATED EPR MAX.
0 to 21 C	.546	.554	.4or	.47:	.4e5	.475	.558	.568	.500	.510
22	.546	.554	.4on	.476	.465	.475	.556	.566	.500	.510
23	.546	.554	.4or	.476	.465	.475	.555	.565	.500	.510
24	.546	.554	.4or	.47n	.4e5	.475	.551	.561	.498	.508
25	.542	.550	.4e2	.472	.4e1	.471	.546	.556	.494	.504
2-	.538	.546	.457	.4e7	.45e	.4oo	.542	.552	.490	.500
27	.534	.542	.452	.4n2	.452	.4e2	.537	.547	.485	.495
28	.529	.537	.448	.458	.448	.458	.533	.543	.481	.491
29	.524	.532	.444	.454	.444	.454	.528	.538	.476	.486
30	.520	.528	.440	.450	.441	.451	.524	.534	.471	.481
31	.515	.523	.436	.446	.436	.446	.519	.529	.4e7	.477
32	.511	.519	.432	.442	.432	.442	.515	.525	.462	.472
33	.50b	.514	.429	.439	.427	.437	.510	.520	.458	.468
34	.502	.510	.424	.434	.423	.433	.506	.516	.453	.463
35	.49s	.506	.419	.429	.419	.429	.502	.512	.449	.459
3-	.493	.501	.415	.425	.415	.425	.497	.507	.445	.455
37	.489	.497	.411	.421	.410	.420	.493	.503	.441	.451
3e	.485	.493	.407	.417	.406	.416	.488	.498	.437	.447
39	.480	.488	.402	.412	.402	.412	.484	.494	.433	.443
40	.47b	.484	.398	.408	.398	.408	.480	.490	.429	.439
41	.472	.480	.394	.404	.394	.404	.475	.485	.425	.435
42	.467	.475	.390	.400	.390	.400	.471	.481	.421	.431
43	.463	.471	.386	.396	.38-	.39-	.467	.477	.417	.427
44	.459	.4e7	.382	.392	.382	.392	.463	.473	.412	.422
45	.454	.4e2	.378	.388	.378	.388	.458	.468	.408	.418
4-	.450	.458	.375	.385	.374	.384	.454	.464	.404	.414
47	.44b	.454	.371	.381	.370	.380	.450	.460	.400	.410
48	.442	.450	.3b7	.377	.367	.377	.446	.456	.396	.406
49	.438	.446	.3n4	.374	.363	.373	.442	.452	.392	.402
50	.434	.442	.3n0	.370	.3n0	.370	.438	.448	.388	.398

EM1-15701-77-516

CR
CR

Rated EPR Limits
Figure 503

R EFFECTIVITY: 001-031 WITHOUT SB78-006
R
R
0038

TAT	TO TAKEOFF COLUMN 1 RATED EPR MIN.	TO TAKEOFF COLUMN 1 RATED EPR MAX.	CLB CLIMB COLUMN 2 RATED EPR MIN.	CLB CLIMB COLUMN 2 RATED EPR MAX.	CRZ CRUISE COLUMN 3 RATED EPR MIN.	CRZ CRUISE COLUMN 3 RATED EPR MAX.	GA GO AROUND COLUMN 4 RATED EPR MIN.	GA GO AROUND COLUMN 4 RATED EPR MAX.
-50 TO +21°C	.546	.554	.488	.496	.457	.465	.559	.567
22	.546	.554	.488	.496	.457	.465	.559	.567
23	.546	.554	.488	.496	.457	.465	.556	.564
24	.546	.554	.488	.496	.457	.465	.552	.560
25	.542	.550	.484	.492	.452	.460	.547	.555
26	.538	.546	.479	.487	.448	.456	.543	.551
27	.534	.542	.474	.482	.444	.452	.538	.546
28	.529	.537	.470	.478	.440	.448	.534	.542
29	.524	.532	.465	.473	.436	.444	.529	.537
30	.520	.528	.461	.469	.432	.440	.525	.533
31	.515	.523	.456	.464	.428	.436	.520	.528
32	.511	.519	.452	.460	.424	.432	.516	.524
33	.506	.514	.448	.456	.419	.427	.511	.519
34	.502	.510	.444	.452	.415	.423	.507	.515
35	.498	.506	.440	.448	.411	.419	.503	.511
36	.493	.501	.436	.444	.406	.414	.498	.506
37	.489	.497	.432	.440	.402	.410	.494	.502
38	.485	.493	.428	.436	.398	.406	.489	.497
39	.480	.488	.423	.431	.394	.402	.485	.493
40	.476	.484	.419	.427	.390	.398	.481	.489
41	.472	.480	.415	.423	.386	.394	.476	.484
42	.467	.475	.411	.419	.382	.390	.472	.480
43	.463	.471	.407	.415	.378	.386	.468	.476
44	.459	.467	.402	.410	.374	.382	.464	.472
45	.454	.462	.398	.406	.370	.378	.459	.467
46	.450	.458	.394	.402	.367	.375	.455	.463
47	.446	.454	.391	.399	.363	.371	.451	.459
48	.442	.450	.387	.395	.360	.368	.447	.455
49	.438	.446	.383	.391	.356	.364	.443	.451
50	.434	.442	.379	.387	.353	.361	.439	.447

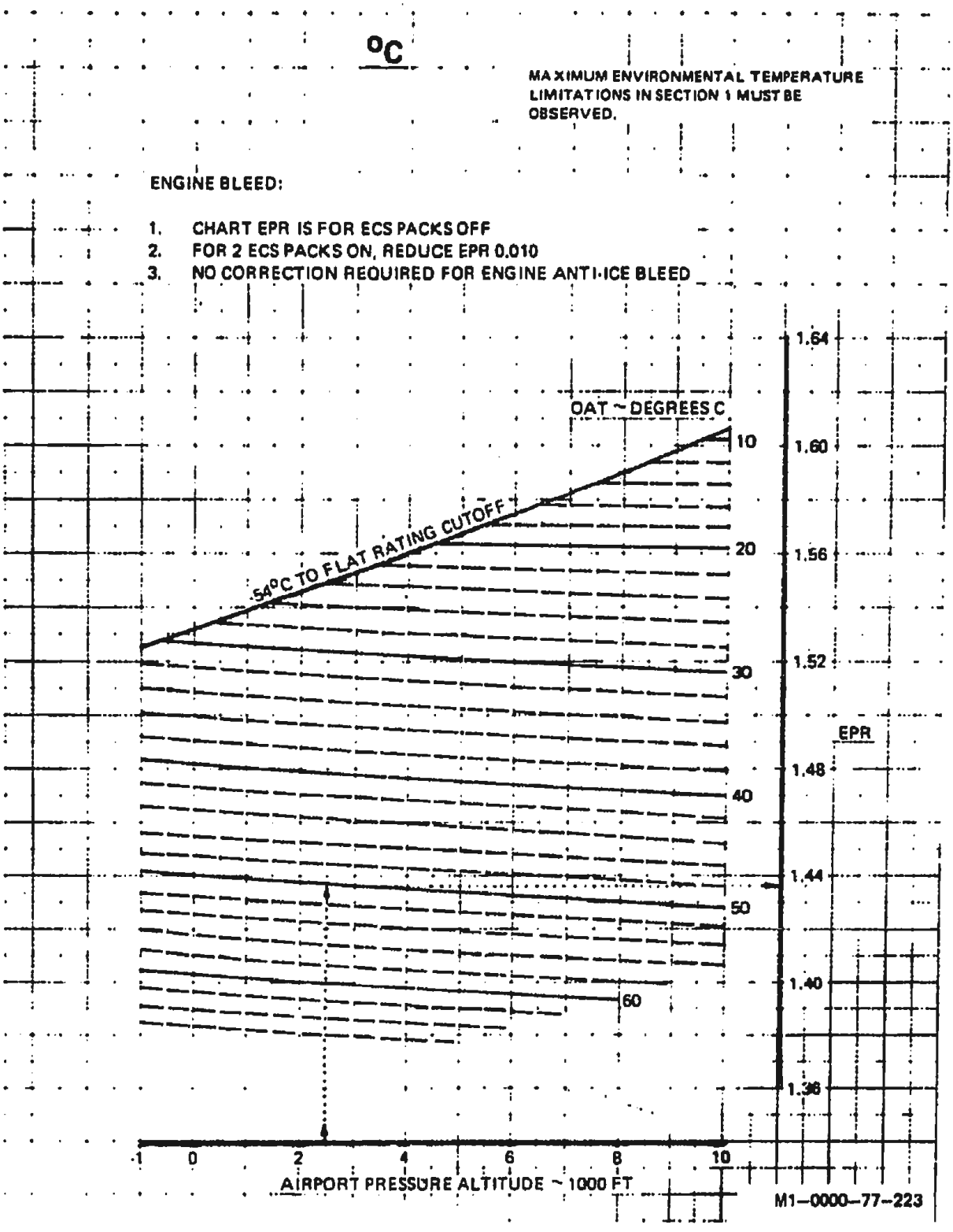
M1-0000-77-216

CR
CR

Rated EPR Limits
Figure 503

R
R
R

EFFECTIVITY: 001-031 WITH SB78-006 AND 032-999



CR Takeoff EPR (40 to 80 Knots)
CR Computer Quick Check
CR Figure 504

R EFFECTIVITY: ALL - SOLID STATE TYPE
R
R
003B

CR (k) Release TEST switch and release NO. 1 switchlight on ENGINE ANTI-ICE control panel to OFF; verify that RATED EPR on indicator is .012 to .014 less than reading noted in Step (f).

CR (l) Release NO. 1 ENG ISLN VALVE switchlight on ENGINE BLEED CONTROL panel to OFF.

CR (m) Release left CROSSBLEED switchlight to OFF.

CR (n) Release NO. 1 PACK FLOW CONTROL switchlight to OFF.

CR (o) Release LEFT MANUAL switchlight on WING ANTI-ICE control panel to OFF.

CR (p) Verify that RATED EPR on indicator is within limits (Ref. Fig. 503, Column 2). Note Reading.

CR (q) Depress right CROSSBLEED switchlight to ON.

CR (r) Depress PACK FLOW CONTROL NO. 3 switchlight to ON; verify that RATED EPR on indicator is within (±) .001 of reading noted in Step (p). Note reading.

CR (s) Depress NO. 3 ENG ISLN VALVE switchlight to ON; verify that RATED EPR on indicator is .012 to .014 less than reading noted in Step (r).

CR (t) Depress No. 3 switchlight on ENGINE ANTI-ICE control panel to ON; verify that RATED EPR on indicator is .018 to .020 less than reading noted in Step (r).

CR (u) Depress RIGHT MANUAL switchlight on WING ANTI-ICE control panel to ON.

CR (v) Depress and hold TEST switch on WING ANTI-ICE control panel; verify that RATED EPR on indicator is .025 to .028 less than reading noted in Step (r).

CR (w) Release TEST switch to OFF.

CR (x) Release NO. 3 switchlight on ENGINE ANTI-ICE panel to OFF; verify that RATED EPR on indicator is .012 to .014 less than reading noted in Step (r).

CR (y) Release ENGINE NO. 3 ISLN VALVE switchlight on ENGINE BLEED CONTROL panel to OFF.

CR (z) Release right CROSSBLEED switchlight to OFF.

CR (aa) Release NO. 3 PACK FLOW CONTROL switchlight to OFF.

CR (ab) Release RIGHT MANUAL switchlight on WING ANTI-ICE control panel to OFF.

CR (14) Perform cruize (CRZ) mode test as follows:

CR (a) Depress CRZ switchlight on RATED EPR MODE panel; verify that CRZ MODE on RATED EPR indicator is displayed and that RATED EPR on indicator is within limits (Ref. Fig. 503, Column 3). Note reading.

CR (b) Depress left CROSSBLEED switchlight on ENGINE BLEED CONTROL panel to ON.

CR (c) Depress NO. 2 PACK FLOW CONTROL switchlight to ON; verify that RATED EPR on indicator is within (±) .001 of reading noted in Step (a). Note reading.

CR (d) Depress NO. 1 ENG ISLN VALVE switchlight to ON; verify that RATED EPR on indicator is .012 to .014 less than reading noted in Step (c).

CR (e) Release NO. 1 ENG ISLN VALVE switchlight to OFF.

CR (f) Release left CROSSBLEED switchlight to OFF.

CR (g) Depress NO. 3 ISLN VALVE switchlight to ON.

CR (h) Depress right CROSSBLEED switchlight to on; verify that RATED EPR on indicator is .012 to .014 less than reading noted in Step (c).

CR (i) Release NO. 2 PACK FLOW CONTROL switchlight to OFF.

CR (j) Release NO. 3 ENG ISLN VALVE switchlight to OFF.

CR (k) Release right CROSSBLEED switchlight to OFF.

CR (15) Perform go around (GA) mode test as follows:

CR (a) Depress GA switchlight on RATED EPR MODE control panel to ON; verify that GA MODE on RATED EPR indicator is displayed and that RATED EPR on indicator is within limits (Ref. Fig. 503, Column 4). Note reading.

CR (b) Depress NO. 1 switchlight on ENGINE ANTI-ICE control to ON; verify that RATED EPR on indicator

CR is .010 to .012 less than reading noted in Step
CR (a).

CR (c) Release NO. 1 switchlight to OFF.

CR (d) Depress LEFT MANUAL switchlight on WING ANTI-ICE
CR control panel to ON.

CR (e) Depress and hold TEST switch on WING ANTI-ICE
CR control panel; verify that RATED EPR on indicator
CR is .010 to .012 less than reading noted in Step
CR (a).

CR (f) Release TEST switch and LEFT MANUAL switchlight to
CR OFF.

CR (g) Depress NO. 1 ENG ISLN VALVE switchlight on ENGINE
CR BLEED CONTROL panel to ON.

CR (h) Depress left and right CROSSBLEED switchlights to
CR ON.

CR (i) Depress NO. 3 PACK FLOW CONTROL switchlight to ON;
CR verify that RATED EPR on indicator is .007 to .009
CR less than reading noted in Step (a).

CR (j) Release NO. 1 ENG ISLN VALVE switchlight to OFF.

CR (k) Release left and right CROSSBLEED switchlights to
CR OFF.

CR (l) Release NO. 3 PACK FLOW CONTROL switchlight to
CR OFF.

CR (m) Remove tag and close circuit breaker MLG GND SENSE
CR (L8).

CR (n) Rotate ALTITUDE REGULATOR on tester to field
CR elevation. Rotate AIRSPEED REGULATOR on tester to
CR 50 knots. When ambient altitude and 50 knots
CR airspeed are reached, close all valves and set
CR POWER switch on tester to OFF.

CR (o) Disconnect test setup (Ref. Fig. 502) and install
CR pitot/static tube caps as required.

CR (p) In forward electronic service center, zone 112,
CR hold BITE test switch on flap load relieving
CR system computer to RESET for five seconds, then
CR return switch to RUN.

CR E. Completion

R EFFECTIVITY: ALL - SOLID STATE TYPE
R
R
003E

CR (1) Disconnect external high pressure air (Ref. 36-13-00).

CR (2) Remove shield from temperature probe No. 2.

CR (3) Turn off electrical power (Ref. 24-41-00).

CR (4) Remove tags and close circuit breakers opened in Step
CR 4A(1).

CR RATED ENGINE PRESSURE RATIO COMPUTER - REMOVAL AND INSTALLATION

CR 1. Removal/Installation

CR A. Removal

CR (1) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag circuit breaker TAT/EPR (R12).

CR (2) Open access door 112AB and enter forward electronic service center, zone 112.

CR (3) Locate the rated engine pressure ratio (EPR) computer on the rear avionics rack, shelf No. 5 (Ref. Fig. 401).

CR (4) Rotate front holddown extractor knobs to release tension (red indicator visible) and separate the extractors from the computer front holddown hooks.

CR (5) Slide computer inboard until electrical connector is disengaged from rack connector and guide pins.

CR (6) Remove computer from rack.

CR B. Installation

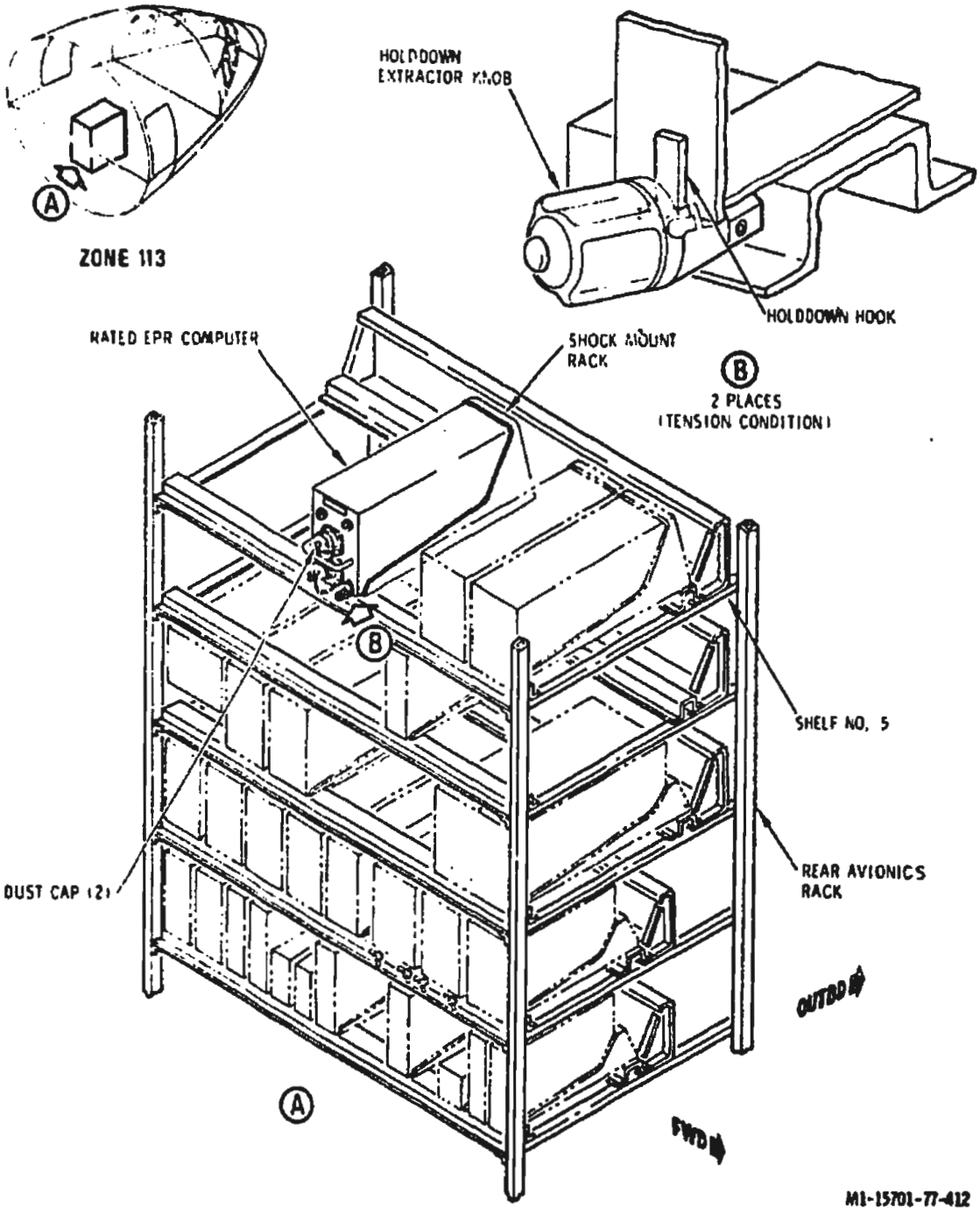
CR (1) Verify that circuit breaker opened in Step A(1) is open and tagged.

CR (2) Lift computer onto shelf No. 5. Slide receiver outboard until electrical connector mates with rack connector and guide pins.

CR (3) Engage front holddown extractors on computer holddown hooks. Tighten extractor knobs until red indicators are not visible.

CR (4) Close and secure access door 112AB.

CR (5) Remove tag and close circuit breaker opened in Step A(1).



CR Rated Engine Pressure Ratio Computer - Removal and Installation
CR Figure 401

EFFECTIVITY: ALL - MAGNETIC WHEEL TYPE

CR RATED ENGINE PRESSURE RATIO COMPUTER - REMOVAL AND INSTALLATION

CR 1. Removal/Installation

CR A. Removal

CR (1) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag circuit breaker TAT/EPR (R12).

CR (2) Open access door 112AB and enter forward electronic service center, zone 112.

CR (3) Locate the rated engine pressure ratio (EPR) computer on the rear avionics rack, shelf No. 5 (Ref. Fig. 401).

CR (4) Rotate front holddown extractor knobs to release tension (red indicator visible) and separate the extractors from the computer front holddown hooks.

CR (5) Slide computer inboard until electrical connector is disengaged from rack connector and guide pins.

CR (6) Remove computer from rack.

CR B. Installation

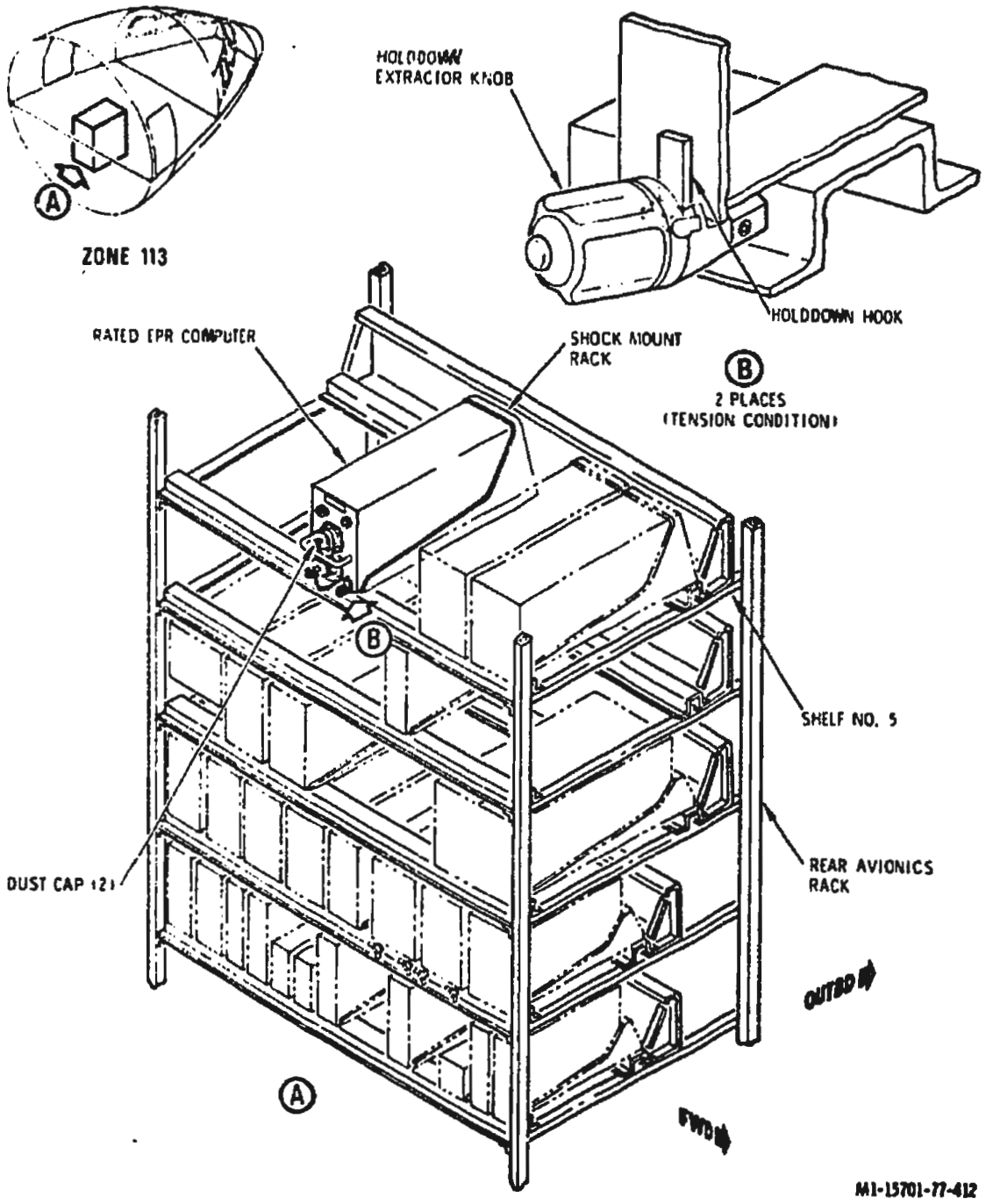
CR (1) Verify that circuit breaker opened in Step A(1) is open and tagged.

CR (2) Lift computer onto shelf No. 5. Slide receiver outboard until electrical connector mates with rack connector and guide pins.

CR (3) Engage front holddown extractors on computer holddown hooks. Tighten extractor knobs until red indicators are not visible.

CR (4) Close and secure access door 112AB.

CR (5) Remove tag and close circuit breaker opened in Step A(1).



CR Rated Engine Pressure Ratio Computer - Removal and Installation
CR Figure 401

R EFFECTIVITY: ALL - SOLID STATE TYPE
R
R
R
0028

C RATED ENGINE PRESSURE RATIO INDICATOR
C REMOVAL AND INSTALLATION

C 1. Referenced Procedure

C 24-41-00 External Power/Ground Source System - Maintenance
C Practices

C 2. Removal/Installation

C A. Removal

C (1) On Flight Engineer/Second Officers aft circuit breaker
C panel CB3, zone 215, open and tag circuit breaker
C TAT/EPR (R12).

C On Flight Engineer/Second Officers overhead circuit
C breaker panel CB2, zone 215, open and tag circuit
C breaker EPR (H6).

C (2) Locate the rated engine pressure ratio (EPR) indicator
C (also termed TAT/EPR indicator) in the upper left
C corner of the pilots center instrument panel, zone 210,
C (Ref. Fig. 401).

C (3) Loosen clamp screw to release rated EPR indicator from
C panel.

C (4) Withdraw indicator and disconnect electrical connector.
C Tape and stow cable connector.

C B. Installation

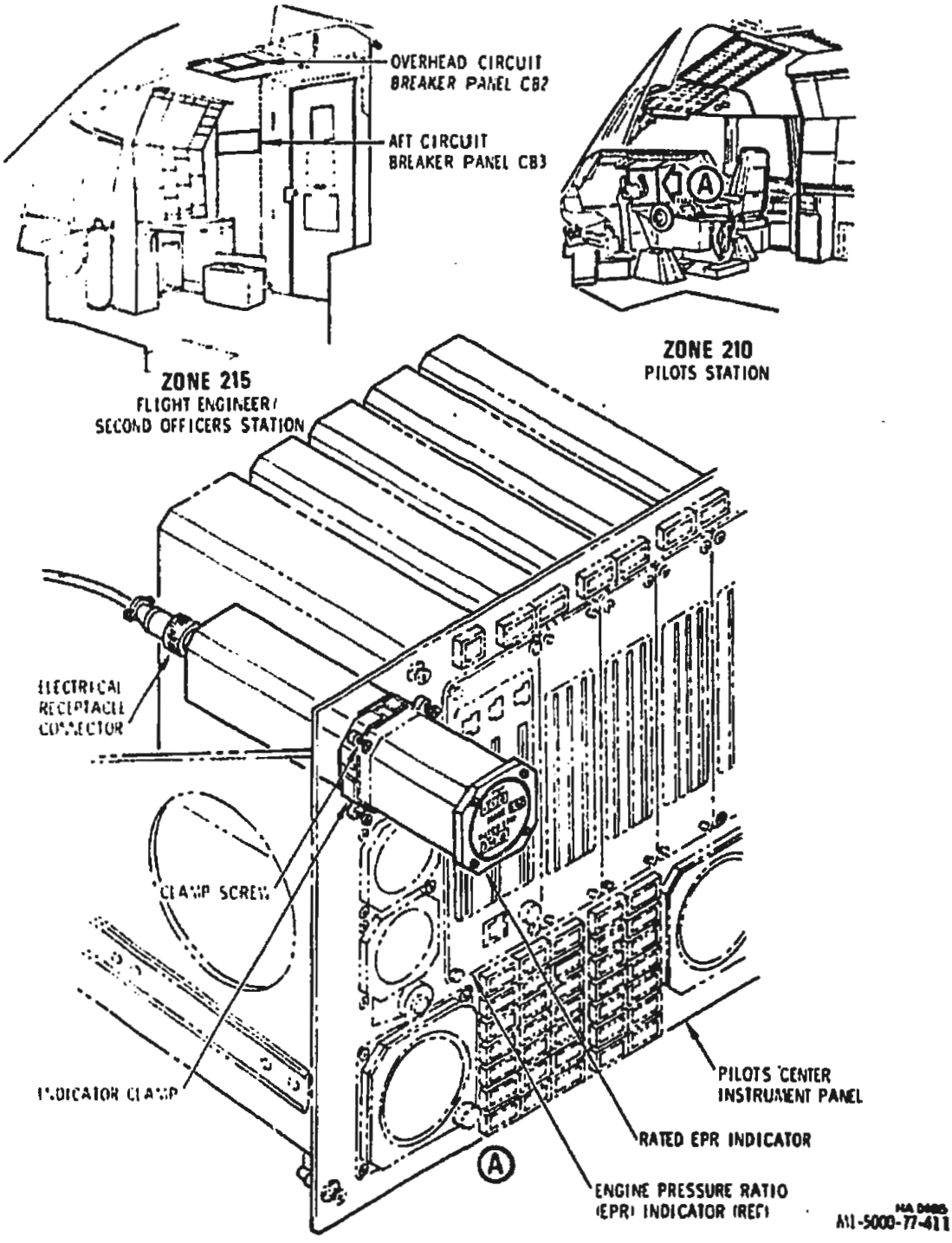
C (1) Verify that circuit breakers opened in Step 2A(1) are
C open and tagged.

C (2) Mate cable connector to indicator receptacle connector.

C (3) Slide indicator into panel cutout until bezel is
C positioned against panel. Secure indicator by
C tightening clamp screw. Torque clamp screws 5 to 8 lb
C in.

C (4) Remove tags and close circuit breakers opened in Step
C 2A(1).

C (5) Turn on electrical power (Ref. 24-41-00).



C Rated Engine Pressure Ratio Indicator - Removal and Installation
C Figure 401

EFFECTIVITY: ALL - MAGNETIC WHEEL TYPE

C (6) Verify that indicator is operable by depressing the
C TAKE-OFF switchlight on the RATED EPR MODE control
C panel, zone 215. Indicator must read TO at MODE
C window.

C (7) Depress each of the other mode switchlights in sequence
C and verify that applicable mode appears at indicator
C MODE window within one second of selection.

C (8) Place thermometer adjacent to total air temperature
C probe No. 2 and shield from direct wind and sunlight.
C Allow temperature to stabilize.

C (9) Verify that TAT on RATED EPR indicator agrees with
C outside static temperature reading on thermometer (±2
C degrees C).

C (10) Remove thermometer and shield from temperature probe
C and turn off electrical power (Ref. 24-41-00).

CR RATED ENGINE PRESSURE RATIO INDICATOR
CR REMOVAL AND INSTALLATION

CR 1. Referenced Procedure

CR 24-41-00 External Power/Ground Source System - Maintenance Practices

CR 2. Removal/Installation

CR A. Removal

CR (1) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag circuit breaker TAT/EPR (R12).

CR On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breaker EPR (H6).

CR (2) Locate the rated engine pressure ratio (EPR) indicator (also termed TAT/EPR indicator) in the upper left corner of the pilots center instrument panel, zone 210, (Ref. Fig. 401).

CR (3) Loosen clamp screw to release rated EPR indicator from panel.

CR (4) Withdraw indicator and disconnect electrical connector. Tape and stow cable connector.

CR B. Installation

CR (1) Verify that circuit breakers opened in Step 2A(1) are open and tagged.

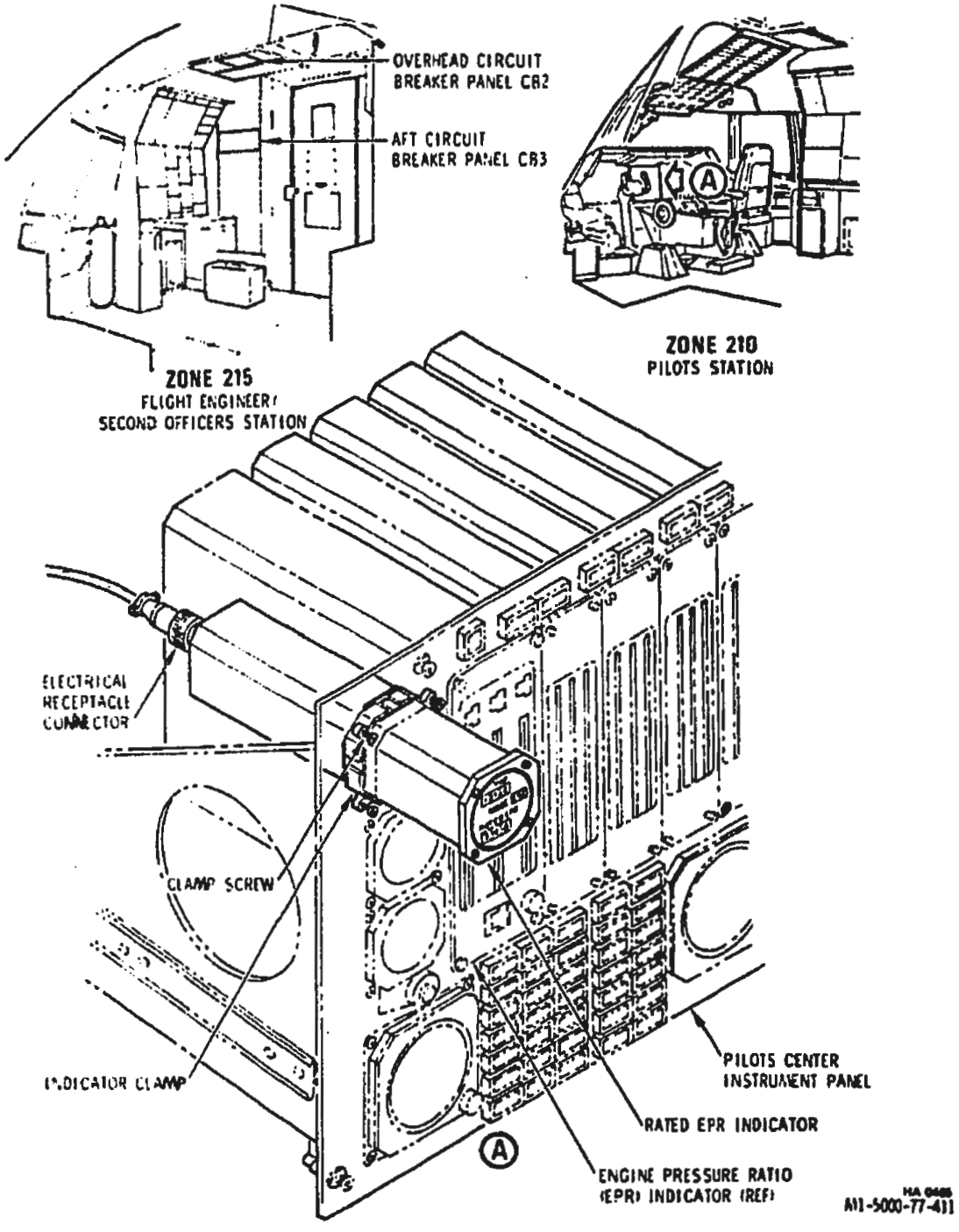
CR (2) Mate cable connector to indicator receptacle connector.

CR (3) Slide indicator into panel cutout until bezel is positioned against panel. Secure indicator by tightening clamp screw. Torque clamp screws 5 to 8 lb in.

CR (4) Remove tags and close circuit breakers opened in Step 2A(1).

CR (5) Turn on electrical power (Ref. 24-41-00).

R EFFECTIVITY: ALL - SOLID STATE TYPE
R
R
0028



CR Rated Engine Pressure Ratio Indicator - Removal and Installation
CR Figure 401

R EFFECTIVITY: ALL - SOLID STATE TYPE
R
R
0028

CR (6) Verify that indicator is operable by depressing the
CR TAKE-OFF switchlight on the RATED EPR MODE control
CR panel, zone 215. Indicator must read TO at MODE
CR window.

CR (7) Depress each of the other mode switchlights in sequence
CR and verify that applicable mode appears at indicator
CR MODE window within one second of selection.

CR (8) Place thermometer adjacent to total air temperature
CR probe No. 2 and shield from direct wind and sunlight.
CR Allow temperature to stabilize.

CR (9) Verify that TAT on RATED EPR indicator agrees with
CR outside static temperature reading on thermometer (±2
CR degrees C).

CR (10) Remove thermometer and shield from temperature probe
CR and turn off electrical power (Ref. 24-41-00).

RATED EPR CONTROL PANEL - REMOVAL AND INSTALLATION

1. Referenced Procedure

   24-41-00 External Power/Ground Service System - Maintenance Practices

2. Removal/Installation

   A. Removal

      (1) On the Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag circuit breaker TAT/EPR (R12).

      On the Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breaker INDICATOR EPR (H6).

      (2) Locate EPR mode control panel at lower right corner of Flight Engineer/Second Officers lower panel.

      (3) Loosen captive trimring fasteners and slide control panel out onto Flight Engineer/Second Officers work table (Ref. Fig. 401).

      (4) Disconnect electrical harness connector from control panel connector.

      NOTE: Front panel removal for switchlight bulb replacement may be performed without removing control panel.

   B. Installation

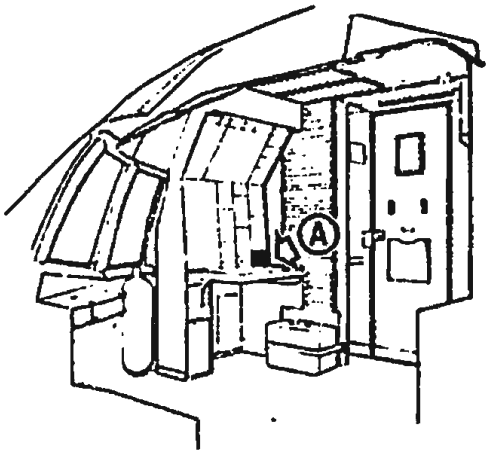
      (1) Verify that circuit breakers opened in Step 2A(1) are open and tagged.

      (2) Mate cable connector to the EPR mode control panel connector.

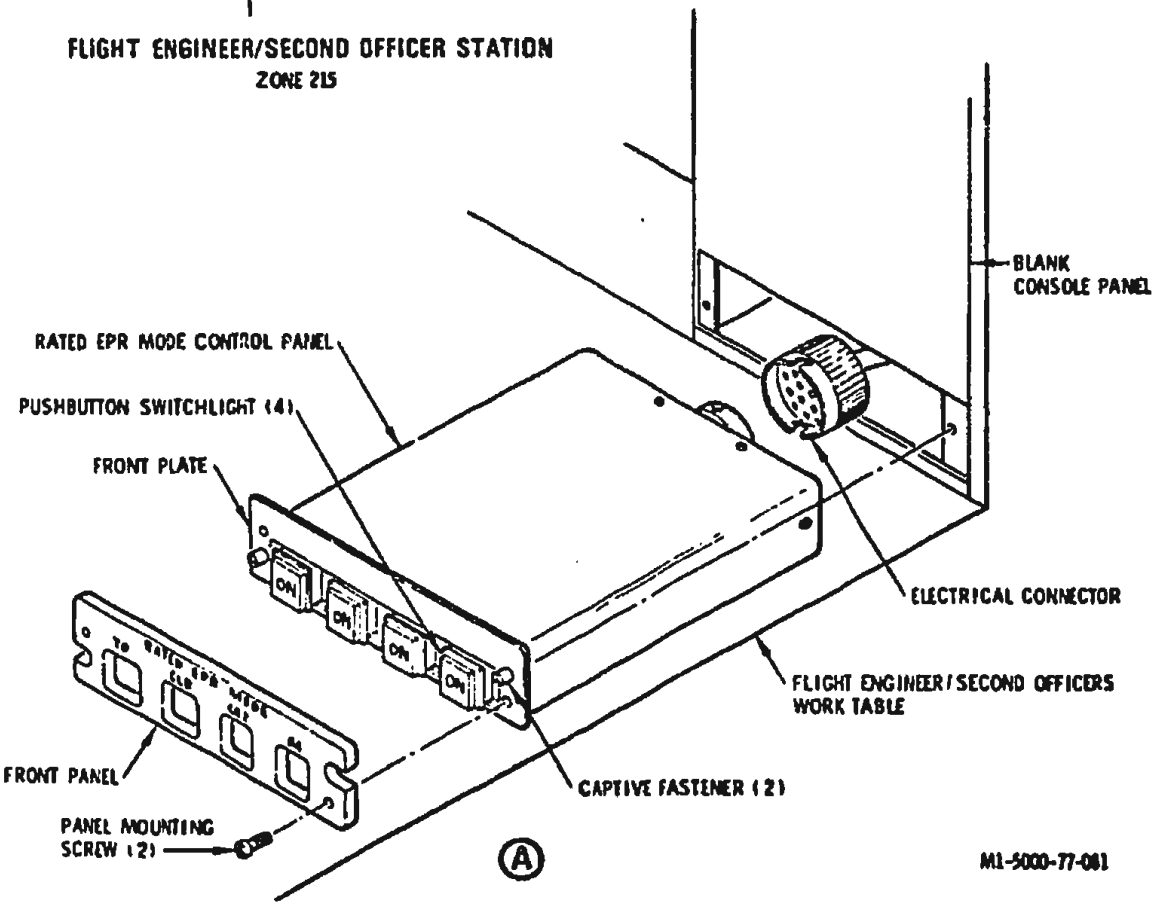
      (3) Slide control panel into instrument panel cutout. Secure unit by tightening fasteners. R

      (4) Remove tags and close circuit breakers opened in Step 2A(1).

      (5) Turn on electrical power (Ref. 24-41-00).



FLIGHT ENGINEER/SECOND OFFICER STATION
ZONE 215



Rated EPR Control Panel - Removal and Installation
Figure 401

(6) Verify that control panel can be operated by depressing mode switchlights in sequence, at 5-second intervals. Observe MODE window on rated EPR indicator (TAT/EPR), zone 210, to verify corresponding changes for applicable mode.

(7) Turn off electrical power (Ref. 24-41-00).

NO. 2 ENGINE-OUT INDICATING SYSTEM - DESCRIPTION AND OPERATION

1. General

The No. 2 engine-out indicating system provides the flight crew with an early and obvious indication of loss of thrust during takeoff. The system is not incorporated on the wing engines as any substantial loss of thrust on a wing engine during takeoff will be felt immediately by the pilot as a yaw moment. Since yaw indication does not exist on the No. 2 engine, recognition time must be reduced to a minimum to alert the flight crew of No. 2 engine failure.

The failure monitoring system is required only during takeoff and must be armed to become functional. Three conditions must be satisfied for the system to become automatically armed: the flaps must be within the takeoff range to close the engine-out flap lever switch, the aircraft on-ground signal must be present to close the air-ground sense relay, and a speed sensitive switch in the intermediate pressure (N2) indicator must be closed (set to close at 82 - 84.5 percent N2 on increasing power and open at 81.5 - 78.7 percent N2 on decreasing power).

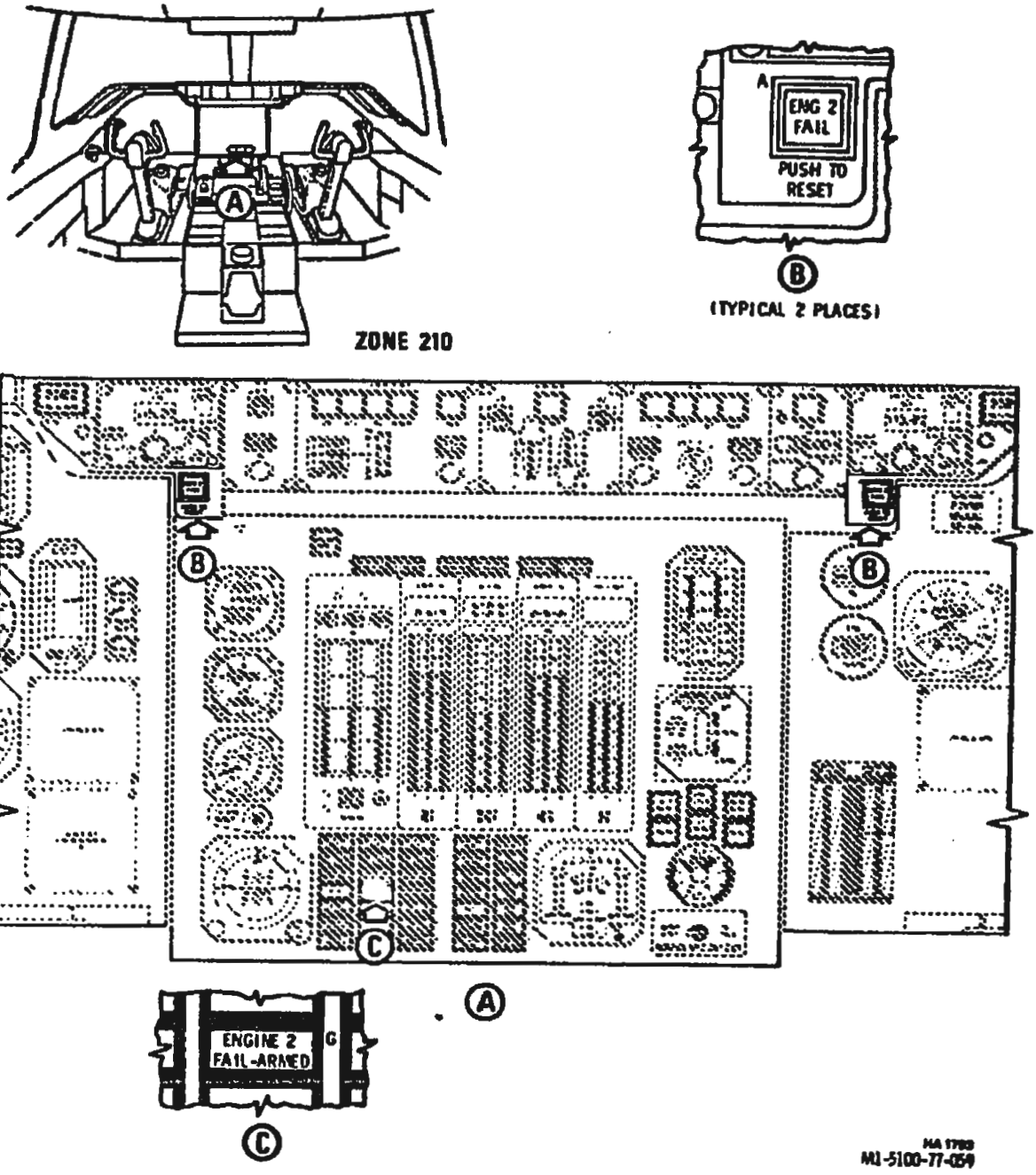
Indication that the system is armed is provided by a green ENGINE 2 FAIL-ARMED light on the pilots caution and warning annunciator panel. Indication of a loss of thrust is provided by two amber ENG 2 FAIL switchlights located on the pilots glareshield panel (Ref. Fig. 1).

The intermediate pressure engine shaft speed indicator, located on the Flight Engineer/Second Officers panel, contains the speed sensitive switch and is the signal source for the engine-out indicating system.

2. Operation

The air-ground sense relay is closed while the aircraft is on the ground and the flap lever switch closes as the pilot selects takeoff flap levers. Upon increasing power for takeoff, the N2 indicator speed sensitive switch closes energizing the N2 tachometer relay and the engine-out light armed relay (Ref. Fig. 2). Contacts of the engine-out light relay complete a self-holding circuit and arms the system turning the ENG 2 FAIL-ARMED light on.

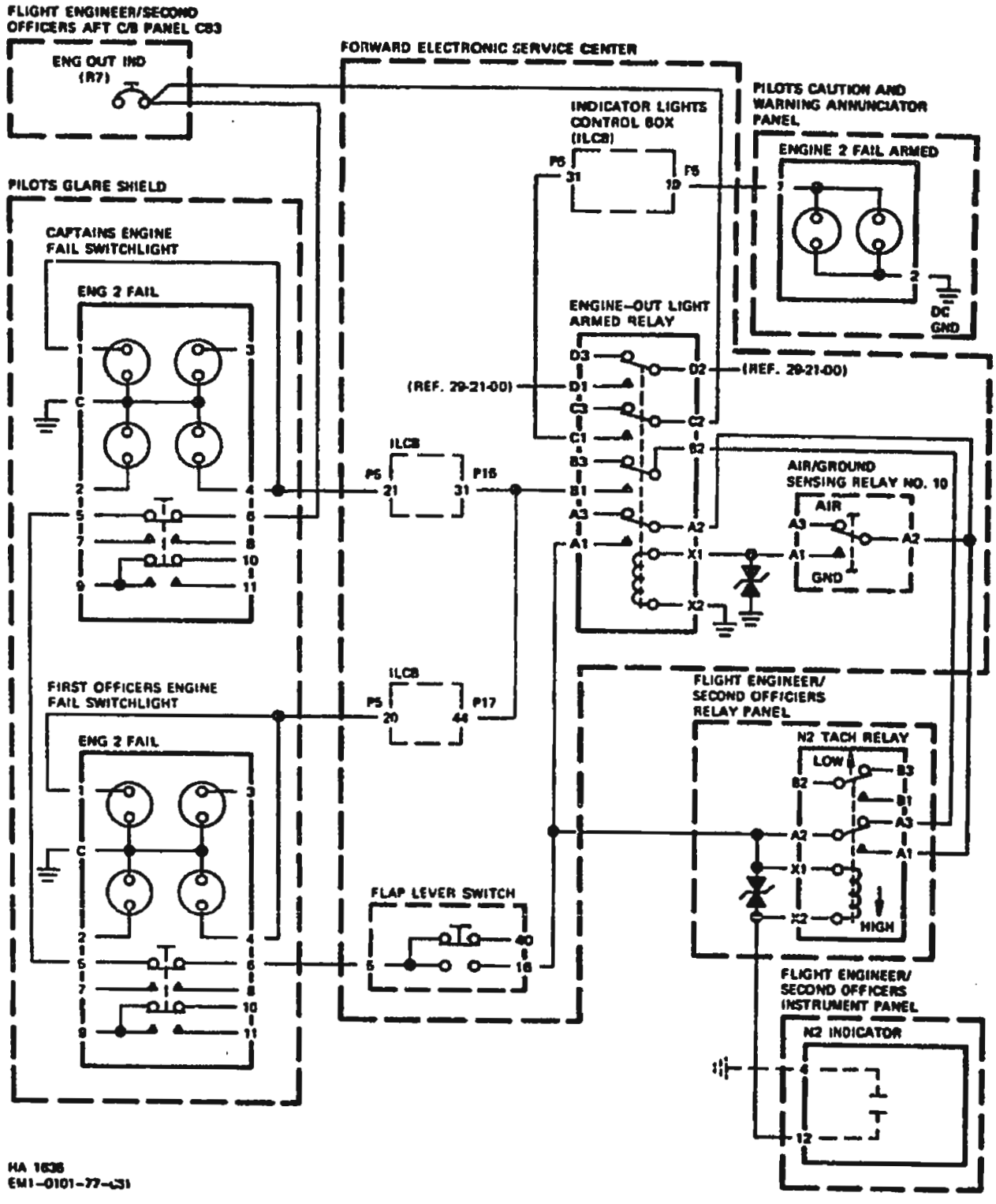
In the event of a loss of thrust resulting with a drop in N2 shaft speed during takeoff, the speed sensitive switch in the N2 indicator will open deenergizing the N2 tachometer relay. Contacts of the deenergized relay complete a circuit through the



Engine No. 2 Fail Indication
Figure 1

engine-out light relay to turn the lights on in both ENG 2 FAIL switchlights, giving the pilot an immediate indication of loss of thrust.

Once the system has been activated, either switchlight may be momentarily depressed to disarm the system and turn the ENG 2 FAIL and the ENGINE 2 FAIL-ARMED lights off. The system will automatically rearm if takeoff thrust is regained during takeoff.



Engine No. 2 Fail Simplified Schematic
Figure 2

R # NO. 2 ENGINE-OUT INDICATING SYSTEM - FAULT ISOLATION

R 1. General

R The fault isolation diagrams in this section can be used for fault isolation any time a fault is reported or suspected. Before fault isolation is started, the PREREQUISITES listed on the diagram must be fulfilled.

R If the flight crew reports a trouble using a FIRM Fault Code number, the number can be found in the FIRM Fault Code Cross Reference Table in the Chapter 77 INDEX.

R The FIRM Fault Code Cross Reference Table includes the flight report (fault symptoms) and the exact Section, Figure, Sheet, and Block number where fault isolation should begin. (Refer to the L-1011 Maintenance Manual Introduction for a more detailed explanation on the use of fault isolation diagrams.)

R If a fault is reported or suspected and no FIRM Fault Code is available, the function or fault indication can be found in the table below. When a diagram is selected in this manner fault isolation is started at Block 1.

R 2. Fault Isolation/Identification

R Table 101 is a list of fault isolation data in this section of the manual.

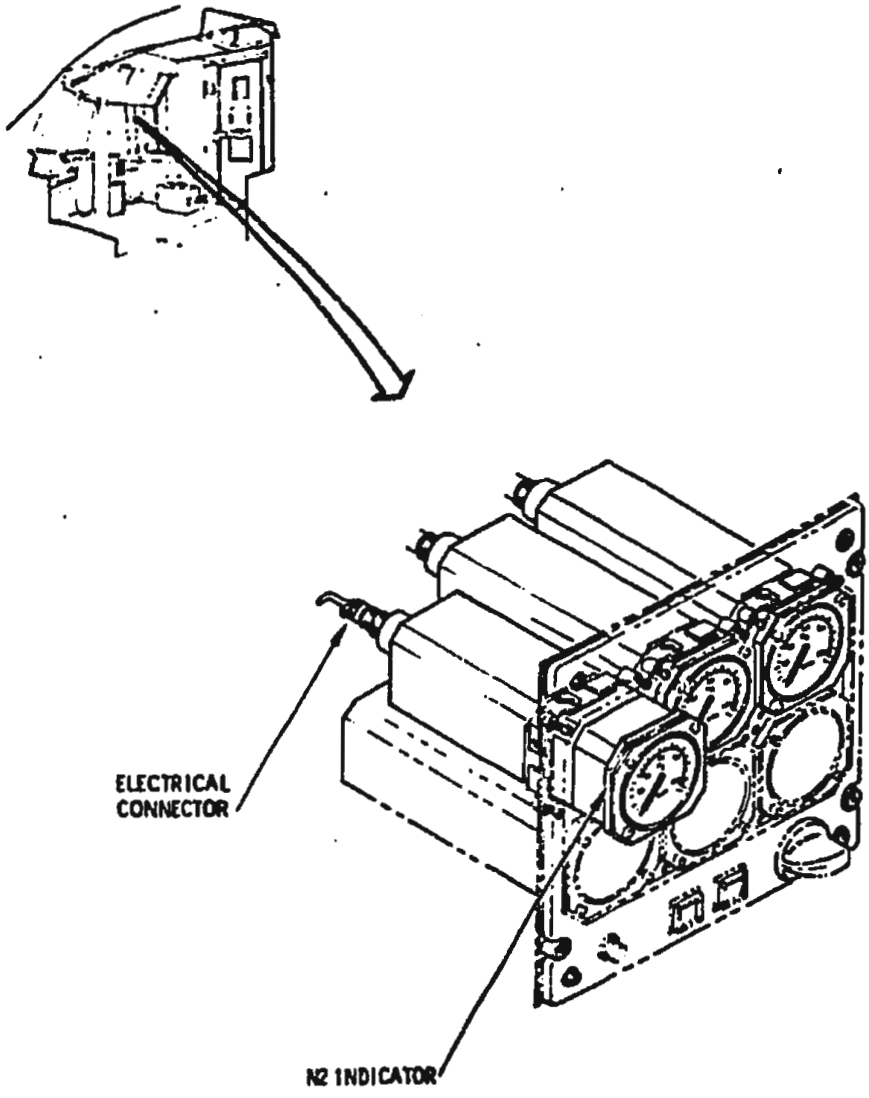
R Fault Isolation Data
R Table 101

FIGURE	TITLE
101	Component Locator Index
102	Component Locator
103	Engine No. 2 Fail Armed Light Problems
SCHEM 1	Engine No. 2 Fail System Circuits

COMPONENT	QTY	AREA/ACCESS	REFERENCE
N2 INDICATOR	3	FLT STATION	

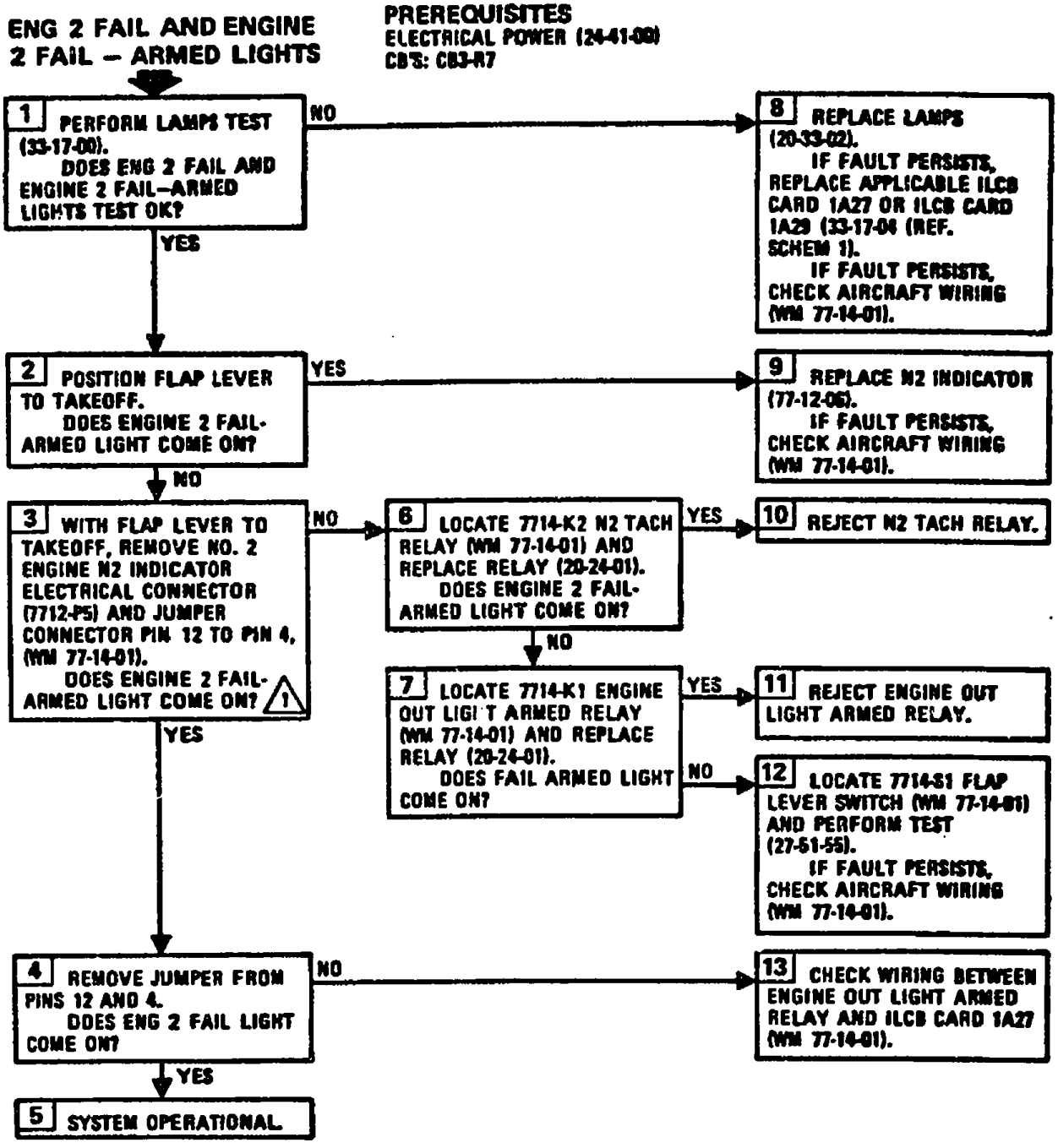
M1-0000-77-192

R Component Locator Index
R Figure 101



M1-0000-77-193

Component Locator
Figure 102

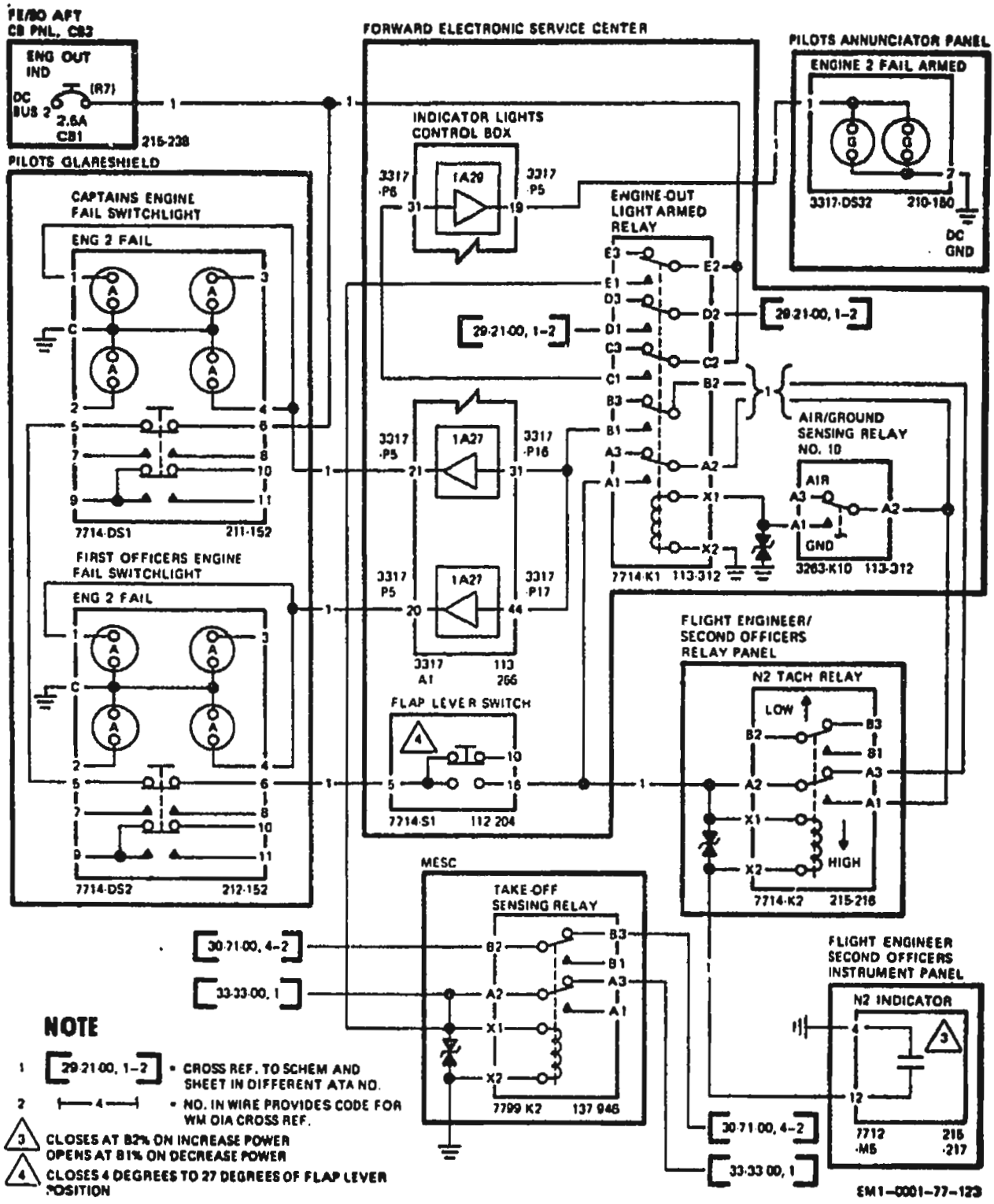

ENG 2 FAIL AND ENGINE 2 FAIL – ARMED LIGHTS
PREREQUISITES
ELECTRICAL POWER (24-41-00)
CBS: CB3-R7
1 PERFORM LAMPS TEST (33-17-00). DOES ENG 2 FAIL AND ENGINE 2 FAIL–ARMED LIGHTS TEST OK?
NO
8 REPLACE LAMPS (20-33-02). IF FAULT PERSISTS, REPLACE APPLICABLE ILCB CARD 1A27 OR ILCB CARD 1A29 (33-17-04 (REF. SCHEM 1). IF FAULT PERSISTS, CHECK AIRCRAFT WIRING (WM 77-14-01).
YES
2 POSITION FLAP LEVER TO TAKEOFF. DOES ENGINE 2 FAIL-ARMED LIGHT COME ON?
YES
9 REPLACE N2 INDICATOR (77-12-06). IF FAULT PERSISTS, CHECK AIRCRAFT WIRING (WM 77-14-01).
NO
3 WITH FLAP LEVER TO TAKEOFF, REMOVE NO. 2 ENGINE N2 INDICATOR ELECTRICAL CONNECTOR (7712-P5) AND JUMPER CONNECTOR PIN 12 TO PIN 4, (WM 77-14-01). DOES ENGINE 2 FAIL-ARMED LIGHT COME ON? 1
NO
6 LOCATE 7714-K2 N2 TACH RELAY (WM 77-14-01) AND REPLACE RELAY (20-24-01). DOES ENGINE 2 FAIL-ARMED LIGHT COME ON?
YES
10 REJECT N2 TACH RELAY.
NO
7 LOCATE 7714-K1 ENGINE OUT LIGHT ARMED RELAY (WM 77-14-01) AND REPLACE RELAY (20-24-01). DOES FAIL ARMED LIGHT COME ON?
YES
11 REJECT ENGINE OUT LIGHT ARMED RELAY.
NO
12 LOCATE 7714-S1 FLAP LEVER SWITCH (WM 77-14-01) AND PERFORM TEST (27-51-55). IF FAULT PERSISTS, CHECK AIRCRAFT WIRING (WM 77-14-01).
YES
4 REMOVE JUMPER FROM PINS 12 AND 4. DOES ENG 2 FAIL LIGHT COME ON?
NO
13 CHECK WIRING BETWEEN ENGINE OUT LIGHT ARMED RELAY AND ILCB CARD 1A27 (WM 77-14-01).
YES
5 SYSTEM OPERATIONAL

1 **NOTE**
IF THE ENGINE 2 FAIL ARMED LIGHT DID NOT COME ON DURING ACTUAL TAKEOFF CONDITIONS BUT DOES COME ON AT THIS POINT, THE CORRECTIVE ACTION IS TO REPLACE THE N2 INDICATOR (77-12-04).

M1-0004-77-122

R R Engine No. 2 Fail Armed Light Problems
Figure 103

R R 001B EFFECTIVITY: ALL



R R Engine No. 2 Fail System Circuits
SCHEM 1

EFFECTIVITY: ALL

001B

No. 2 ENGINE-OUT INDICATING SYSTEM - ADJUSTMENT AND TEST

1. General

This procedure is to allow the functional testing of the No. 2. engine out indicating system without operating the engine.

2. Referenced Procedures

24-00-00 Electrical Power

24-41-00 External Power/Ground Service System

29-11-00 Hydraulic Power System

3. Adjustment/Test

R (1) Verify circuit breakers ENG NO. 2 - TACH N2 (P9) and ENG OUT IND (R7) on Flight Engineers circuit breaker panel CB3, zone 215, are closed.

(2) Turn on electrical power, reference MM 24-00-00 and 24-41-00.

R (3) Verify Hydraulic Systems "A" and "C" are turned off and
R place Flap Selector Lever in the 10° detent position (Ref. 29-11-00).

(4) On flight engineers engine status panel, locate No. 2. engine N2 indicator.

R (5) Depress N2 indicator BITE switch. Verify ENGINE 2 FAIL
R - ARMED annunciator light (green) on the pilots caution
R and warning panel, zone 210, comes on and indicator
R pointer moves upward.

(6) Release N2 indicator BITE switch after indicator pointer reaches and stabilizes at approximately 91
R percent indication. Verify the two ENG 2 FAIL
R switchlights, located on the pilots glareshield panel,
R zone 210, come on and indicator pointer drops to zero.

R (7) Turn off the ENGINE 2 FAIL ARMED annunciator light and the two ENG 2 FAIL switchlights by depressing either one of the ENG 2 FAIL switchlights.

R (8) Return Flap Selector Lever to the detent position corresponding with actual flap position.

(9) Turn off electrical power (Ref. 24-00-00 and 24-41-00).

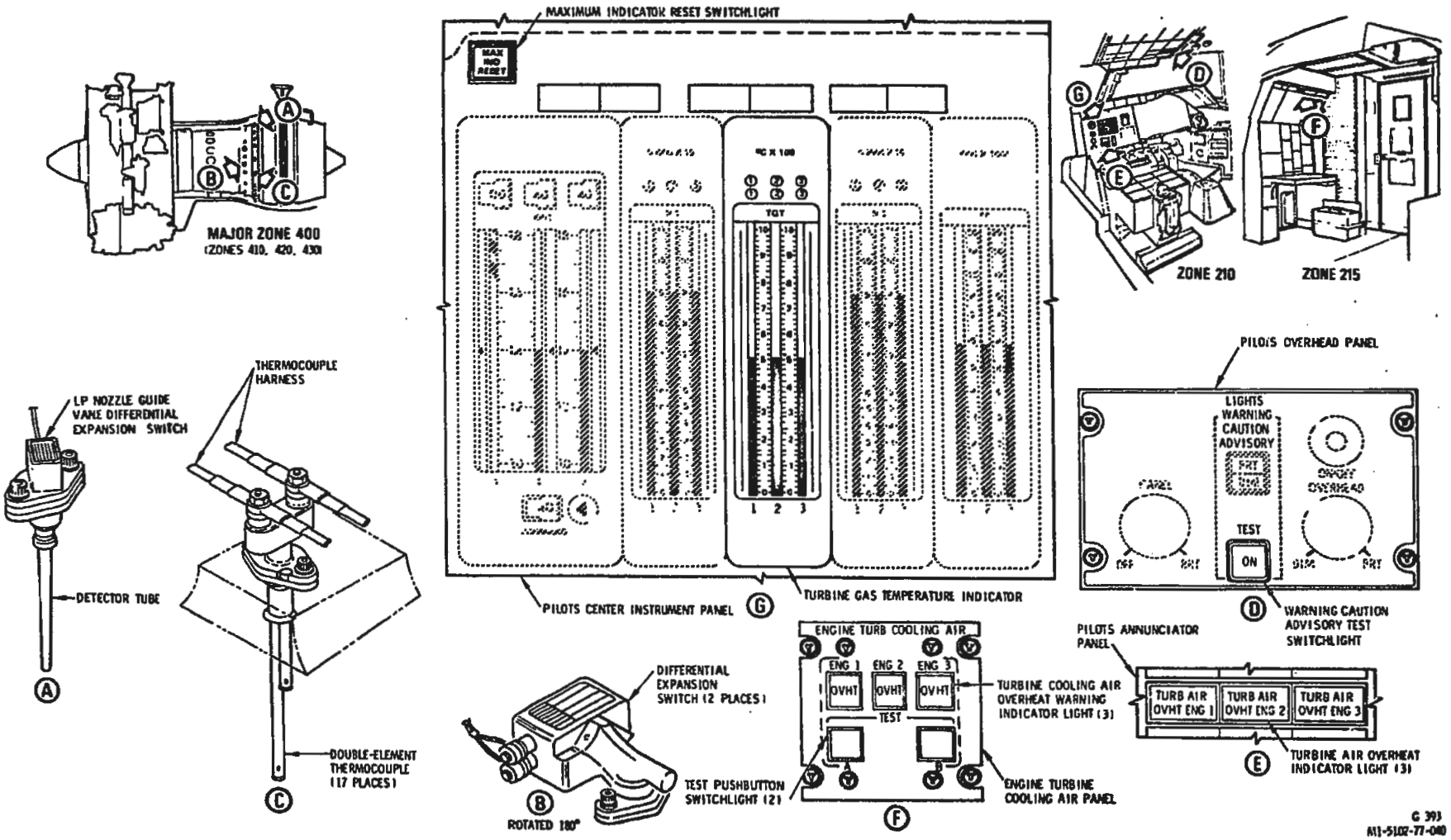
TEMPERATURE - DESCRIPTION AND OPERATION

1. General

A turbine gas temperature (TGT) indicating system and a turbine cooling-air overheat warning indicating system (Ref. Fig. 1) provide the flight crew with engine temperature data.

The TGT system comprises a series of thermocouples, an indicator, and a terminal block for each engine. Hot stream gas temperature is sensed at the low-pressure (LP) Stage 1 nozzle guide vanes. The electric signal produced by the thermocouple is provided to the indicator and to the LP shaft speed and TGT control signal amplifier (Ref. 73-20-00). A test connector is incorporated to facilitate ground testing.

The engine turbine cooling-air overheat indicating system for each engine consists of a group of differential-expansion (Bimetal) switches, an indicator light on the pilots center instrument panel, and a warning indicator light on the ENG TURB COOLING AIR panel, zone 215.



R R Engine Temperature Indicating System Components
Figure 1

EFFECTIVITY: ALL

001B

TURBINE GAS TEMPERATURE INDICATING SYSTEM DESCRIPTION AND OPERATION

1. General

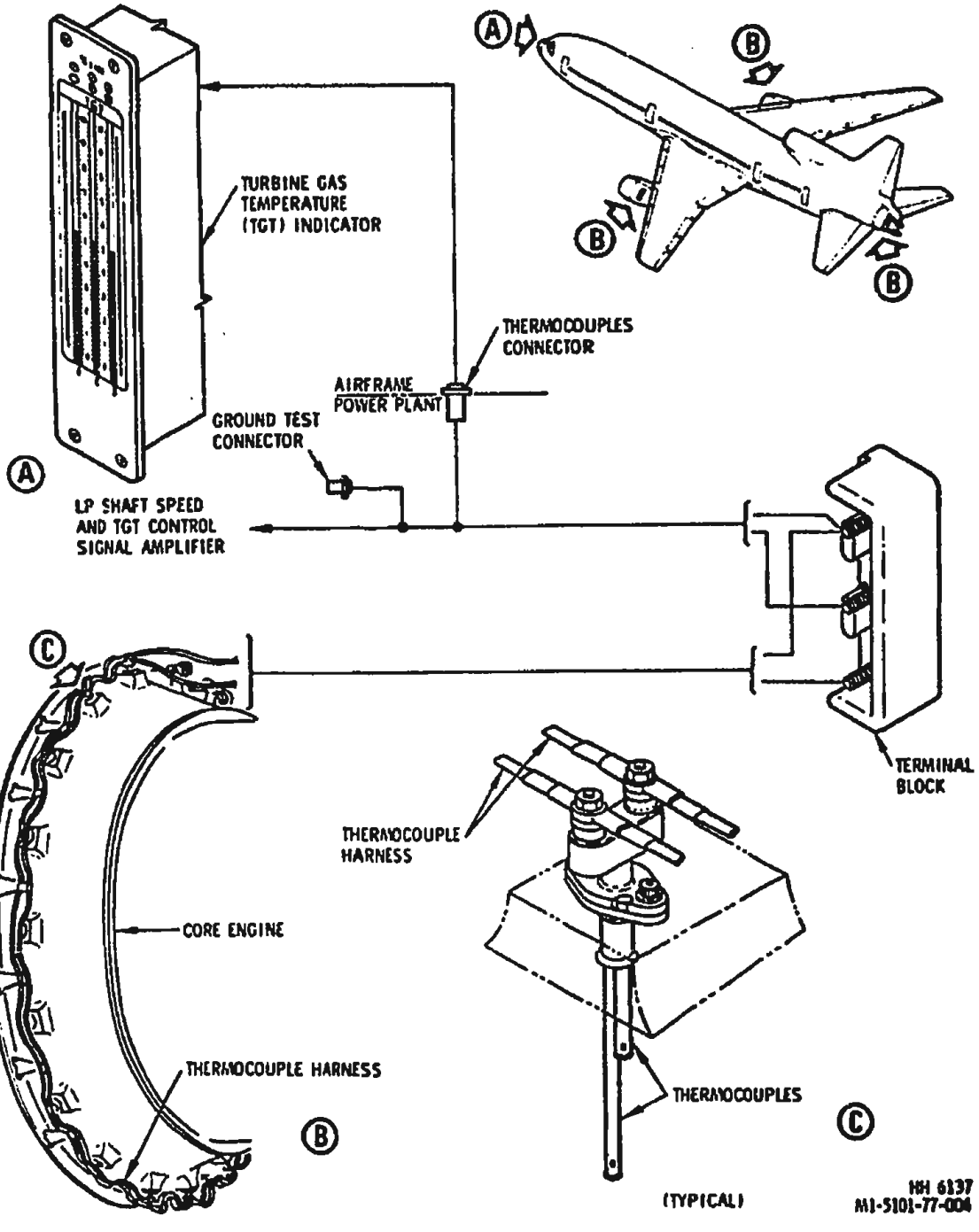
Turbine gas temperature (TGT) is monitored by components of the turbine gas temperature indicating system (Ref. Fig. 1 and 2). Low-pressure (LP) turbine inlet temperature is measured to provide an indication of effective engine operation. Indication is achieved by measuring the electrical signal produced by thermocouples positioned to sense the temperature of the hot stream gases. The signal is transmitted to an indicator in the flight station and displayed as a temperature reading. A signal is also taken to the low-pressure LP shaft speed and TGT control signal amplifier and to the TGT (T7) test connector. A single three-scale TGT indicator on the pilots center instrument panel, zone 210, displays the temperature in degrees C.

Seventeen dual-element thermocouples are equally spaced around each engine, zones 412, 422, and 432. They are located in 17 of the LP turbine Stage 1 nozzle guide vanes to sense turbine inlet temperature. Since each thermocouple has two elements of different lengths, temperatures are actually sensed at 34 points on the engine. Parallel harnesses are connected to either the positive nickel-chromium terminal posts or to the negative nickel-aluminum posts. Leads connect the two harnesses to a terminal block (Ref. Fig. 3). Additional wiring connects the block to the TGT indicator at the flight station.

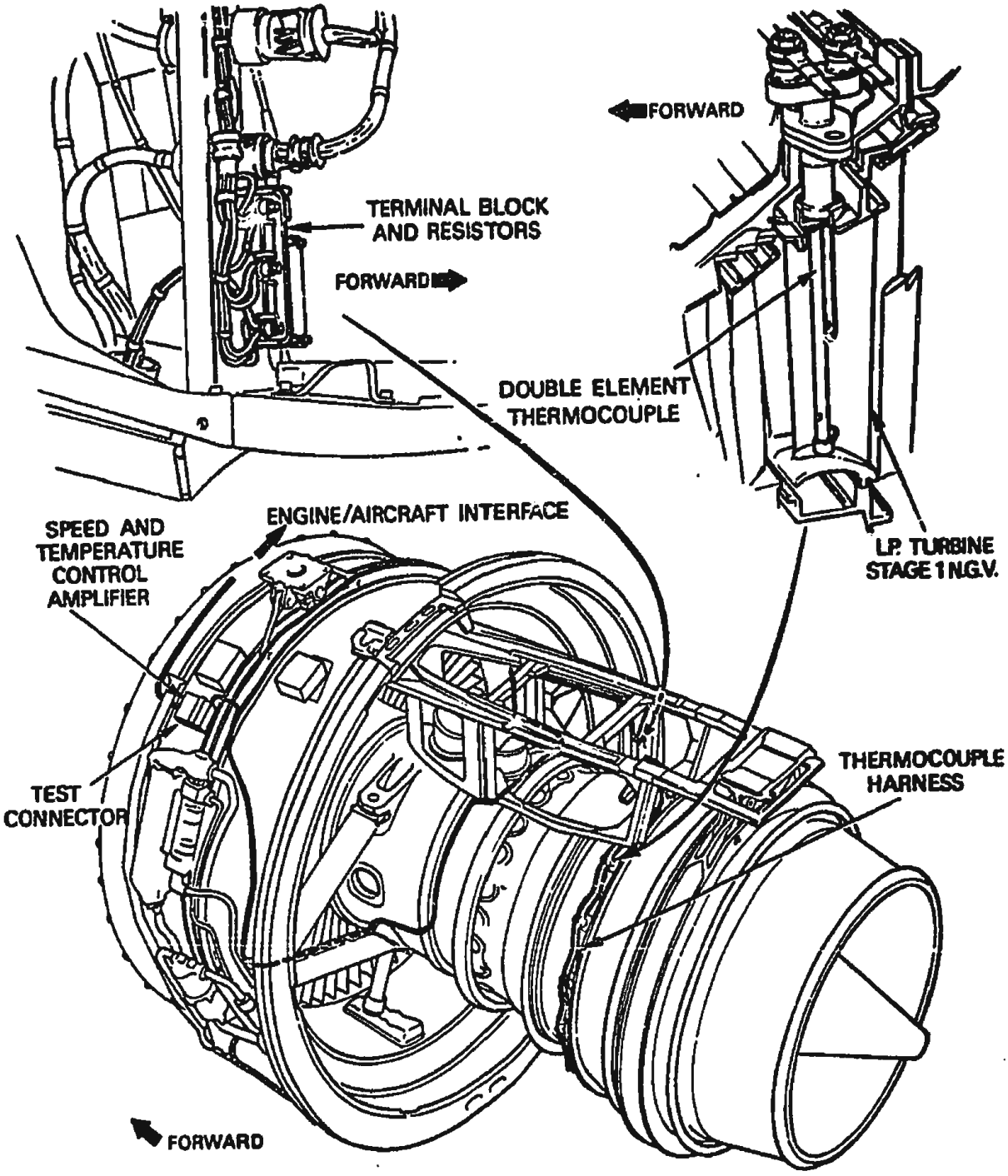
A trim resistor and a fixed value ballast resistor are fitted in the terminal block. These form a potential divider system across the output of the thermocouples to give a reduced voltage
R signal to the indicating system, resulting in a reduced
R indicated TGT compared with that sensed by the thermocouples.
R The value of the ballast resistor fitted is determined by the
R modification standard of the engine and is recorded, with the
R resistor code letter, on the engine data plate.

The system is temperature-compensated, through the construction of the ballast resistor, to provide for terminal block temperature variations.

The voltage signal produced by the thermocouples is routed to the applicable indicator where it is conditioned to drive the vertical-tape display. The electrical circuit is completed by the junction of dissimilar metals in each thermocouple element (hot junction) and the indicator (cold junction). A compensator on each indicator prevents variations of cold junction temperatures from affecting the thermocouple output.



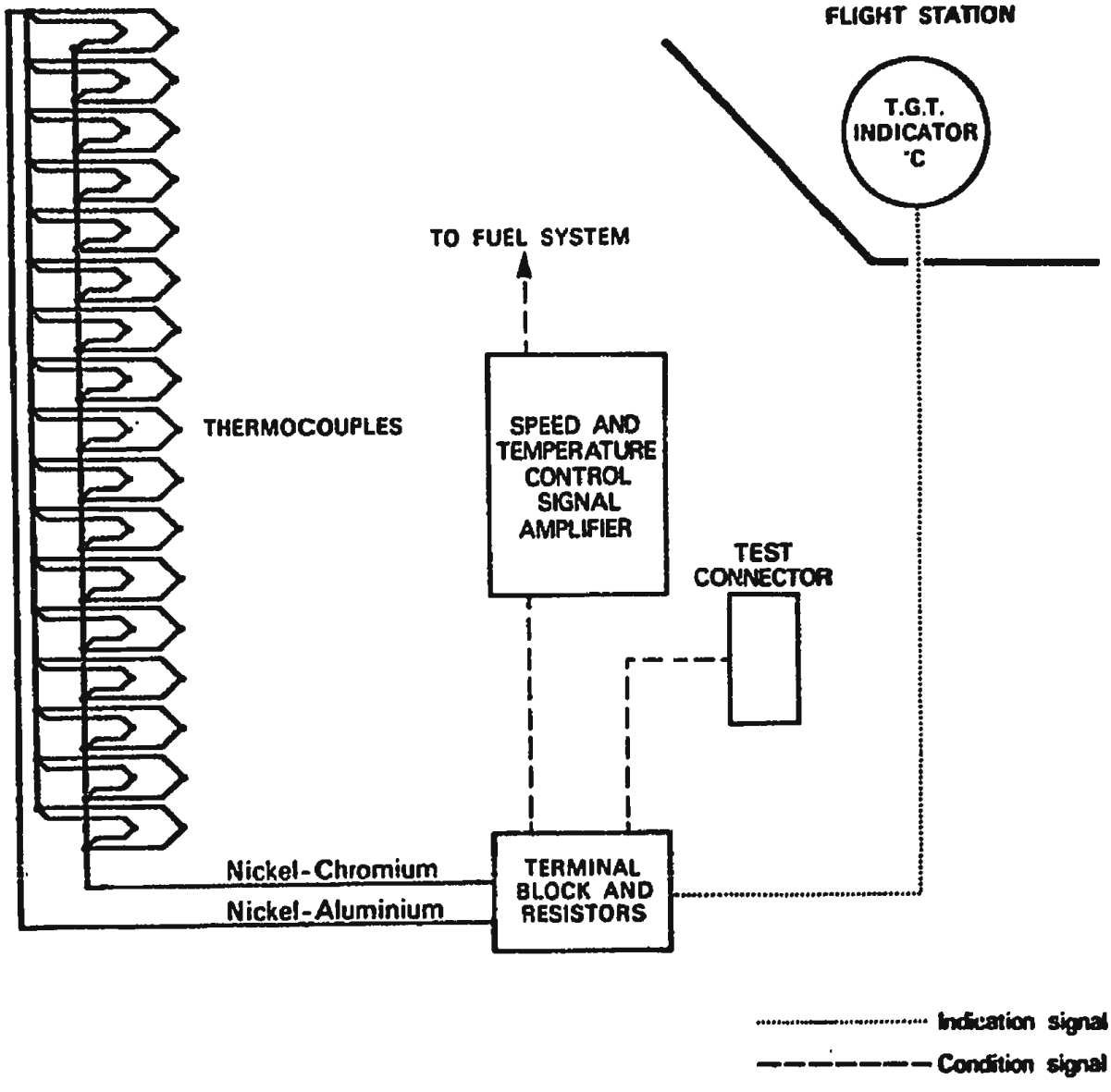
Turbine Gas Temperature Indicating System
Figure 1



35462A
M1-0102-77-078

R Turbine Gas Temperature Engine Units
R Figure 2

EFFECTIVITY: ALL



35451
M1-0102-77-077

R
R

TGT Simplified Diagram
Figure 3

EFFECTIVITY: ALL

2. Operation

When an engine is operating, hot stream gases flow through holes in the nozzle guide vanes to heat the hot junctions of the thermocouples. The voltage signal produced by the junction of the two dissimilar metals is measured by the TGT indicator (Ref. Fig. 4), and is displayed in degrees C. The potential divider system reduces the voltage signal to the indicator and thus the indicated temperature by an amount proportional to the value of the ballast resistor.

The full voltage signal from the thermocouples is transmitted to the LP shaft speed and TGT control signal amplifier (Ref. Fig. 5). There, it is supplied to a reference circuit within the amplifier and is also cold-junction compensated. Operation of the amplifier in connection with the fuel system is described in 73-21-00.

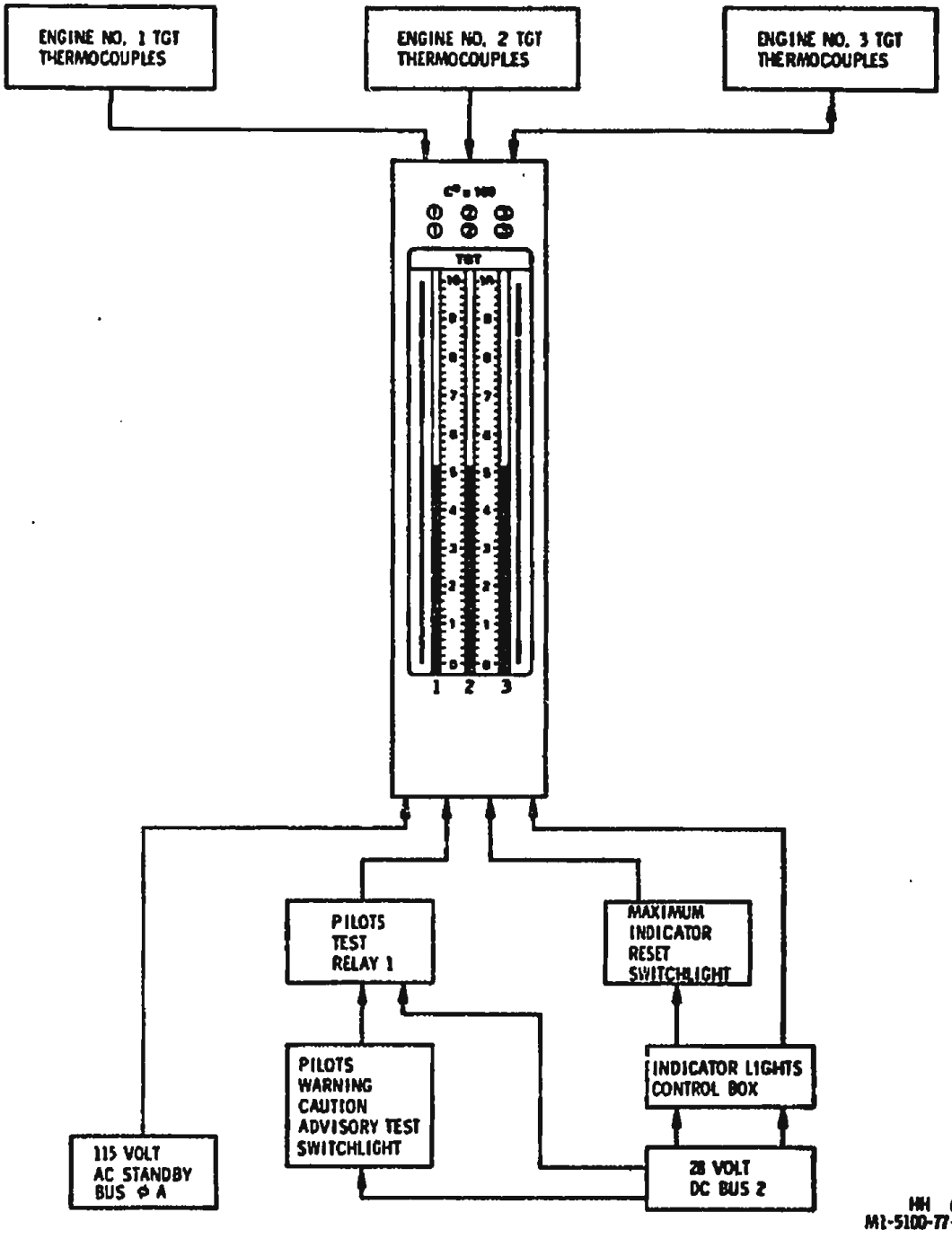
Actuation of the MAX IND RESET switchlight on the pilots center instrument panel, causes the six overtemperature warning lights on the indicator to go out. Actuation of the WARNING CAUTION ADVISORY TEST switchlight causes all of the overtemperature warning lights to come on. When the switchlight is released, the warning lights go out.

3. Thermocouple

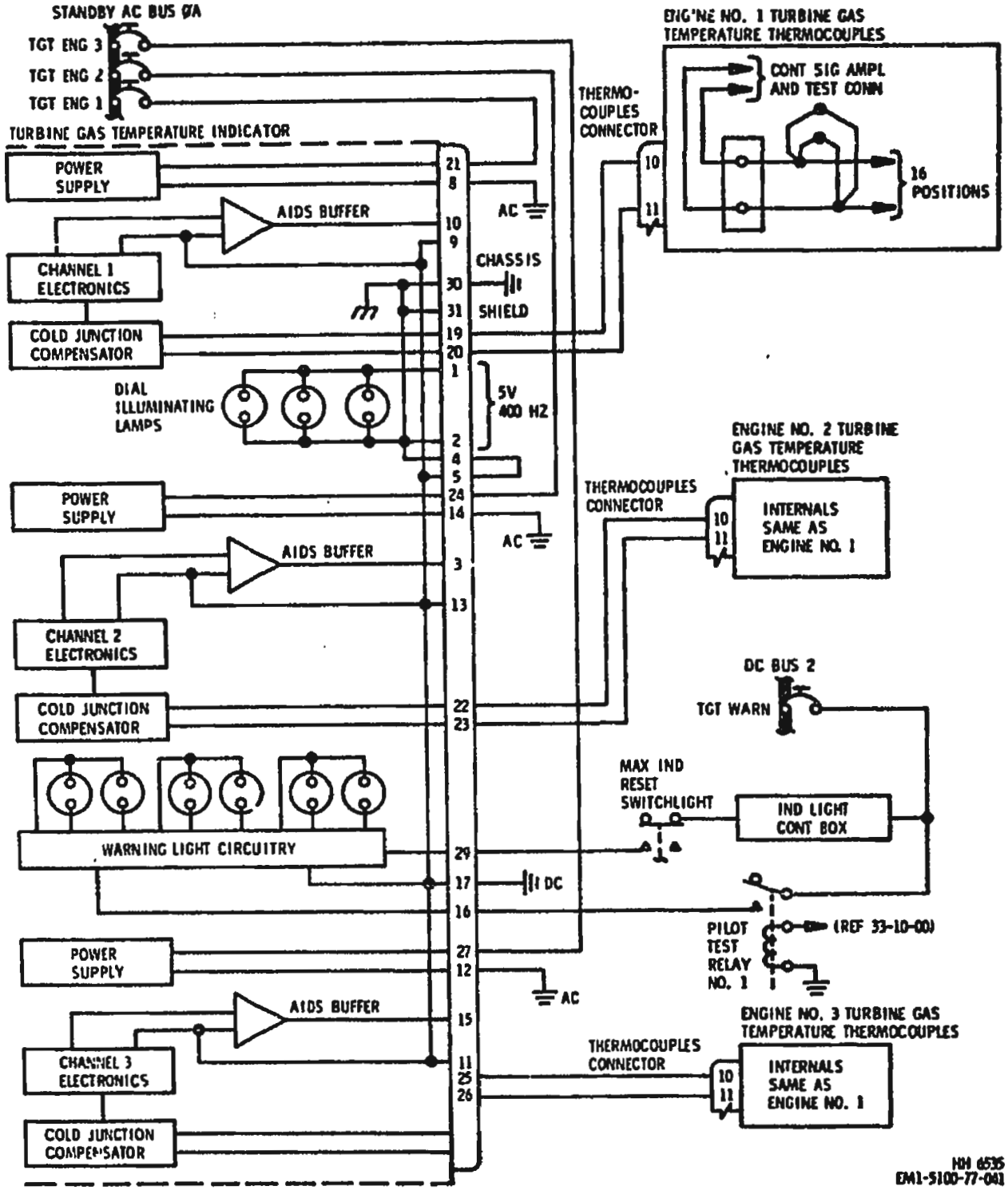
A. Description and Operation

Each thermocouple comprises two metal sheaths brazed together and attached to a mounting flange and terminal head. The two metal sheaths are of different lengths and enclose bi-metal elements that are joined at their lower ends. Holes in the sheaths allow hot stream gases to flow around the bi-metal junctions. The two elements are insulated from the sheaths and connected in parallel to two insulated terminal posts. The posts are of different size and the insulations are colored white (positive) and green (negative) to correspond with the thermocouple harness.

A mounting flange incorporates a locating hole that, on installation, mates with a pin on a mounting sleeve to ensure the thermocouple is positioned with the gas inlet hole facing the gas stream. The hot stream gases enter the metal sheaths through the forward facing holes and, after circulating around the bi-metal element junctions, pass through the rearward facing holes.

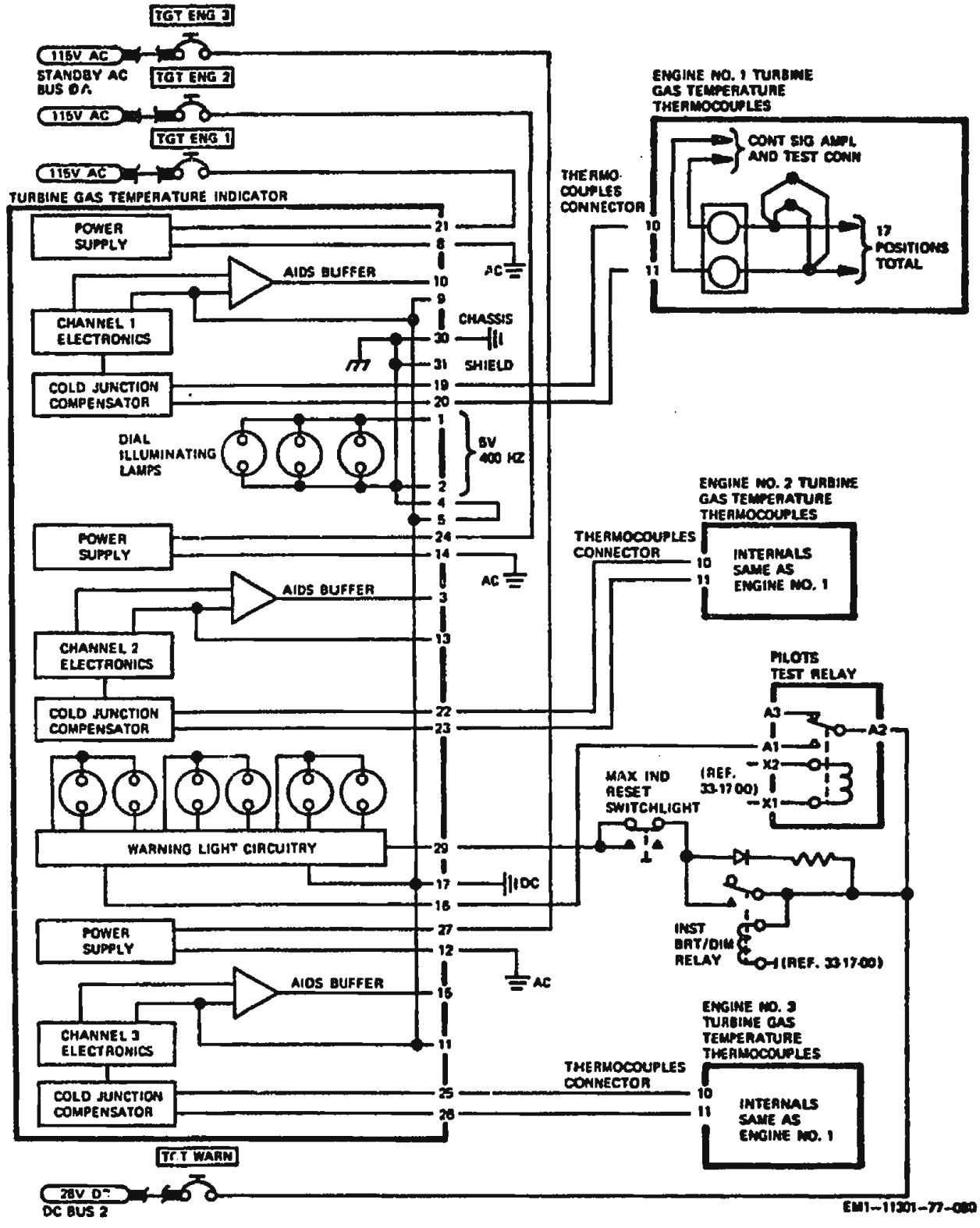

ENGINE NO. 1 TGT THERMOCOUPLES
ENGINE NO. 2 TGT THERMOCOUPLES
ENGINE NO. 3 TGT THERMOCOUPLES
TGT
1 2 3
PILOTS TEST RELAY 1
MAXIMUM INDICATOR RESET SWITCHLIGHT
PILOTS WARNING CAUTION ADVISORY TEST SWITCHLIGHT
INDICATOR LIGHTS CONTROL BOX
115 VOLT AC STANDBY BUS ϕ A
28 VOLT DC BUS 2
HH 6047
M1-5100-77-036

TGT System Block Diagram
Figure 4



TGT Indicating Simplified Schematic
Figure 5 (Sheet 1)

EFFECTIVITY: 001-006 without SB 33-020



TGT Indicating Simplified Schematic
Figure 5 (Sheet 2)

EFFECTIVITY: 001-006 WITH SB 33-020 AND 007-999

4. Turbine Gas Temperature Indicator

A. Description

A single three-scale, vertical-tape, turbine gas temperature (TGT) indicator (Ref. Fig. 6) is located on the pilots center instrument panel, zone 210. The indicator provides the Captain and First Officer with an analog display of the hot gas stream temperature for each engine.

The TGT indicator consists of a bevel-edge case, a vertical scale plate, six warning lights (three red and three amber), three analog scale tapes, and three dc torquers. The tapes have white and black sections. A red segment marked with an OFF legend is at one end of the tape. Signal-conditioning and tape-driving electronic components are contained in the case. All electronic circuitry is packaged on replaceable, plug-in printed circuit boards. The indicator is not hermetically sealed. Indicator illuminating lamps are replaceable through a covered opening on the side of the indicator.

The scale plate is graduated to indicate temperatures to 1000 degrees (C). Range marks are provided on each side of the tape scales. The marks are colored for easy
R identification as follows:

R Green Band 300 to 700 degrees C°

R Yellow Band 700 to 738 degrees C°

R Red Band 738 to 1000 degrees C°

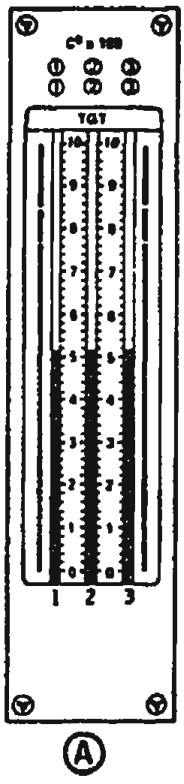
A tape cut-off circuit positions each tape to display the word OFF should a low power condition or power failure occur to or within that channel in the indicator.

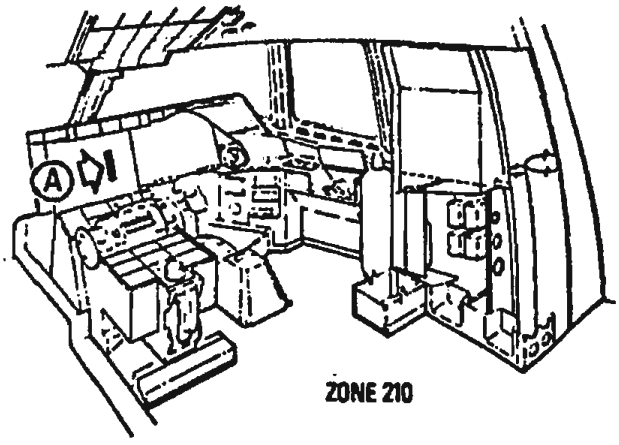
An overtemperature warning light system, consisting of an amber light and a red light for each engine, is located above the tape display.

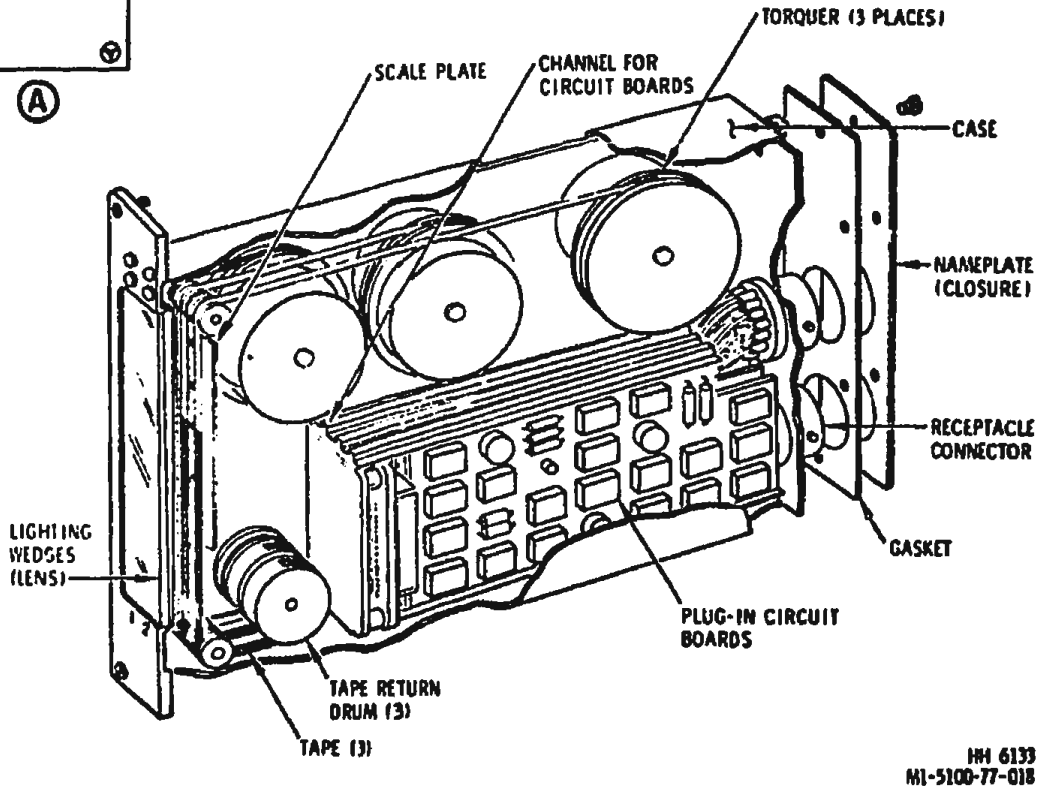
B. Operation

The TGT indicator operates on 115V, 400-Hz power (Ref. Fig. 7). The indicator input signal is a voltage from the group of chromel-alumel thermocouples in the low-pressure Stage 1 nozzle guide vanes. The input voltage is proportional to turbine gas temperature.

The indicator input circuit is a measuring bridge circuit which is compensated for cold junction effects. The chromel and alumel leads are continuous from the engine thermocouple







Turbine Gas Temperature Indicator
Figure 6

to the compensating resistors in the indicator. Provision is made in the indicator for connection to the aircraft integrated data system (AIDS) recorder.

The warning lights operate in the following manner:

(1) The amber light comes on steady when the indicated temperature reaches 740 to 750 degrees C. The amber light will go out when the temperature decreases below 740 degrees C.

(2) The red light flashes when the indicated temperature reaches 770 to 780 degrees C. If this temperature is maintained for less than five seconds and then decreases, the flashing red light goes out. If the temperature is maintained at or above 770 degrees C for more than five seconds, the flashing red light comes on steady. The MAX IND RESET switchlight must be
R depressed to turn the red light out.

The vertical tape is attached to a torquer drum which moves with a torquer rotor. There is no gearing involved. Upscale movement of the torquer causes the tape to be wound on the drum against a spring return torque. The spring return acts to unwind the tape downscale in the absence of upscale torque developed in the rotor.

In the event a low voltage or a voltage failure exists, the spring return mechanism moves the tape downscale into a position to display the word OFF.

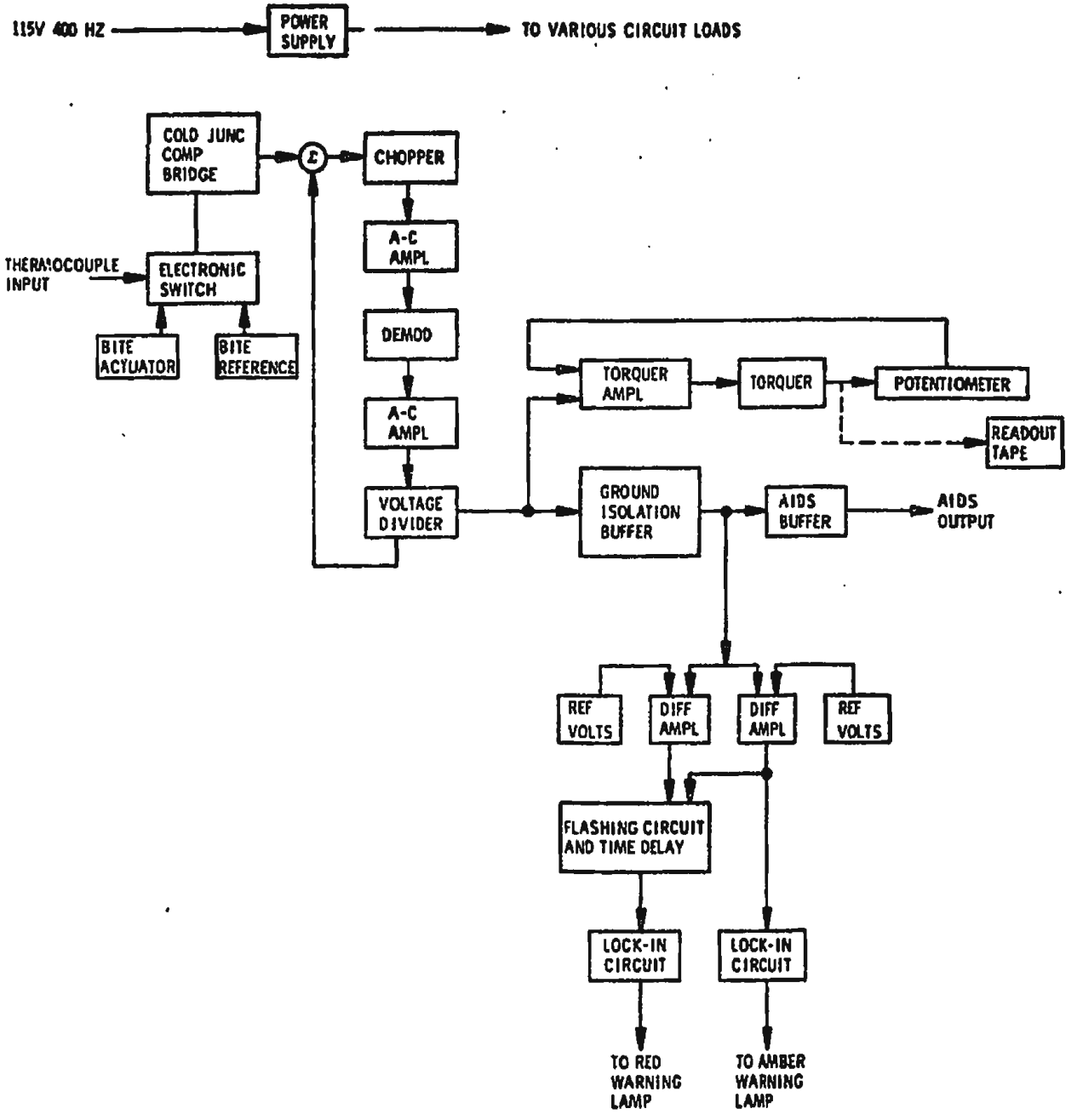
5. TGT Electrical Cables and Terminal Block

A. Description

Extension leads connect the thermocouple harness to the terminal block located on the interservices fairing support structure. The leads are colored white (positive) and green (negative) to correspond with the thermocouple harness.

The terminal block (Ref. Fig. 8) accommodates two resistors that form a potential divider system. The system comprises a trim resistor of high resistance value and a ballast resistor of a lower value, selected to match the modification standard of the engine.

The trim resistor has terminal holes of different diameters and the ballast resistor has terminal holes of the same diameter, to mate with the terminal posts in the terminal block.



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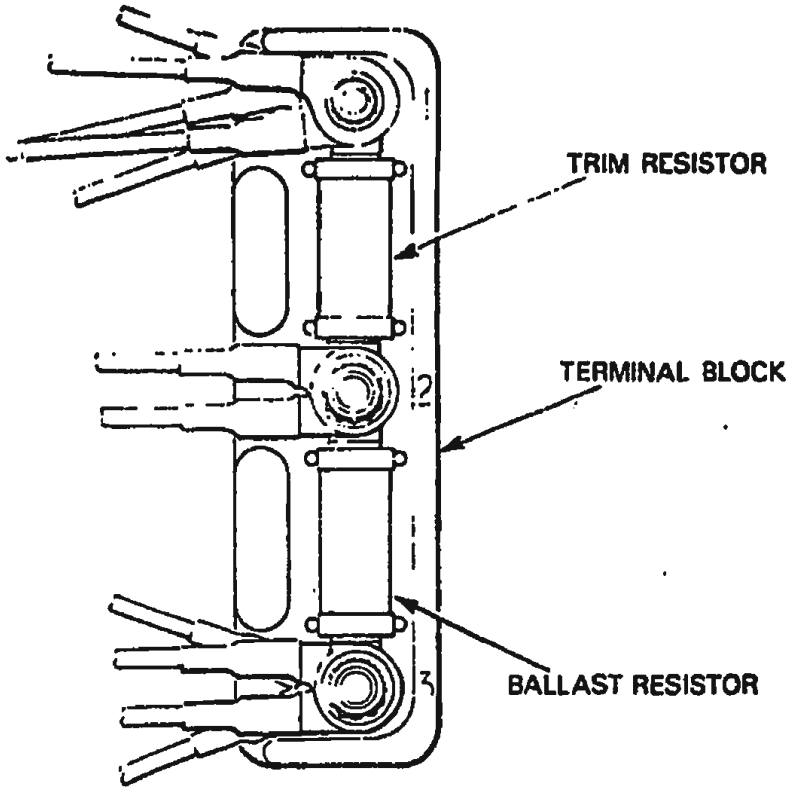
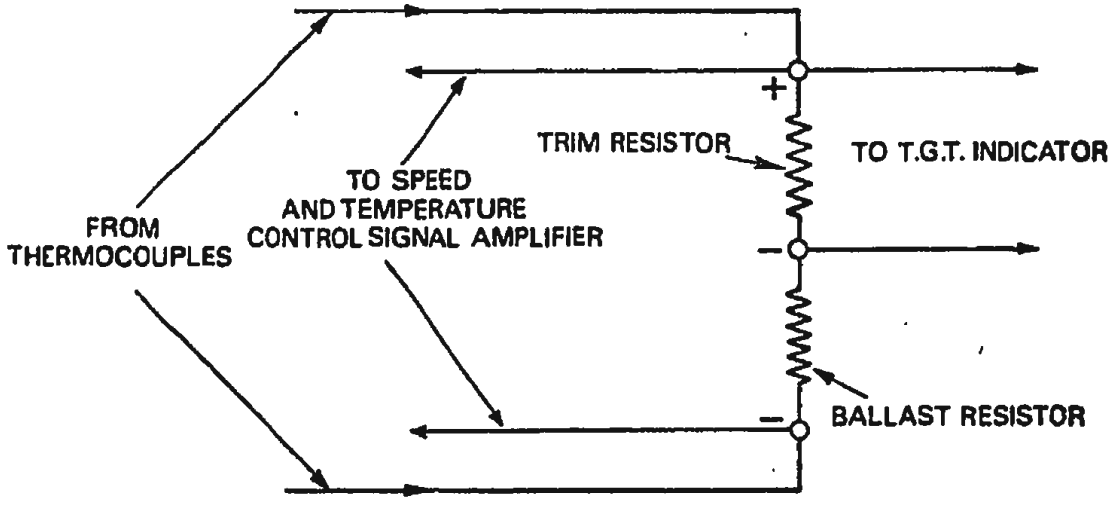
Turbine Gas Temperature Indicator Block Diagram
Figure 7

6. Thermocouple Harness

A. Description

The thermocouple harness, located in zones 412, 422 and 432, consists of a positive and negative lead, which together form a matched pair. Each lead consists of a flat braided conductor within an insulation sleeve. Captive nuts, fitted with plain and spring washers, are secured to terminal plates that are spot welded to the braided conductor. The captive nuts secure the leads to the thermocouple terminal posts. The insulation sleeve of each lead is colored to aid identification, white being positive and green being negative.





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R
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Terminal Block and Resistors
Figure 8

TURBINE GAS TEMPERATURE (TGT) INDICATING SYSTEM FAULT ISOLATION

1. General

The fault isolation diagrams in this section can be used for fault isolation any time a fault is reported or suspected. Before fault isolation is started, the PREREQUISITES listed on the diagram must be fulfilled.

If the flight crew reports a trouble using a FIRM Fault Code number, the number can be found in the FIRM Fault Code Cross Reference Table in the Chapter 77 INDEX.

The FIRM Fault Code Cross Reference Table includes the flight report (fault symptoms) and the exact Section, Figure, Sheet, and Block number where fault isolation should begin. (Refer to the L-1011 Maintenance Manual Introduction for a more detailed explanation on the use of fault ioslation diagrams.)

If a fault is reported or suspected and no FIRM Fault Code is available, the function or fault indication can be found in Table 101 or 102. When a fault isolation diagram is selected in this manner fault isolation is started at Block 1.

2. Supplemental Data

Wiring runs from engine interface connectors to TGT indicators in flight station possess the following resistance values per foot of length:

• Alumel wire	0.1620 ohms per ft.
• Chromel wire	0.3880 ohms per ft.

Each run must be continuous, engine to flight station. Each of the intermediate connectors between engines and indicators must mate, Alumel to Alumel and Chromel to Chromel. Crossed wiring (Alumel connected to Chromel) will throw the TGT indicator values out of calibration.

The most difficult misconnection to detect is the double cross, Alumel to Chromel at two connectors. This introduces two additional cold junctions in the thermocouple circuit, but will appear to be correct at the indicator and engine interface connections. The usual effect of double crossed connectors is
R that TGT for engine involved will read 10 to 20 degrees C low or
R high depending on the location of the cold junctions and
R environmental temperature. A resistance check of the chromel-alumel leads, engine interface to indicator, should

assist in determining where the leads are crossed by calculating the length of the crossed run.

Table 101 is a list of faults, indications, and action that is based on the resistors being identified by their terminal location on the terminal block rather than referring to them as the trim and ballast resistors.

TGT Terminal Fault Isolation
Table 101

FAULT	EFFECT ON INDICATION	ACTION
One thermocouple shorted to its case (either chromel or alumel)	Negligible	None
One thermocouple with an open circuit	Small change depending on difference between specific thermocouple and average temperature.	None
One thermocouple with a short between terminals	Decrease of approximately 25°C when operating at 600°C TGT.	Clear short or replace thermocouple
Resistor between terminals 1 & 2 of terminal block open	Increase to untrimmed TGT value (approx. 60°C increase)	Replace resistor
R R R Resistor between terminals 1 & 2 of terminal block shorted.	Reading will decrease to terminal block ambient temperature.	Replace resistor
Resistor between terminals 2 & 3 of terminal block open	Reading will go to zero and off flag will be displayed.	Replace resistor
Resistor between terminals 2 & 3 of terminal block shorted.	Increase to untrimmed TGT valve (approx. 60°C increase)	Replace resistor
Thermocouple Extension Lead Open.		

TGT Terminal Fault Isolation (Cont)
Table 101

FAULT		EFFECT ON INDICATION	ACTION
(A)	Between thermocouple and terminal block	Reading will decrease to terminal block ambient temperature.	Replace extension lead.
(B)	Between terminal block and indicator	Reading will go to zero & off flag will be displayed.	Replace extension lead.
Thermocouple extension lead grounded		Negligible	None

3. Fault Isolation

Table 102 is a list of all fault isolation data in this section of the manual.

Fault Isolation Data
Table 102

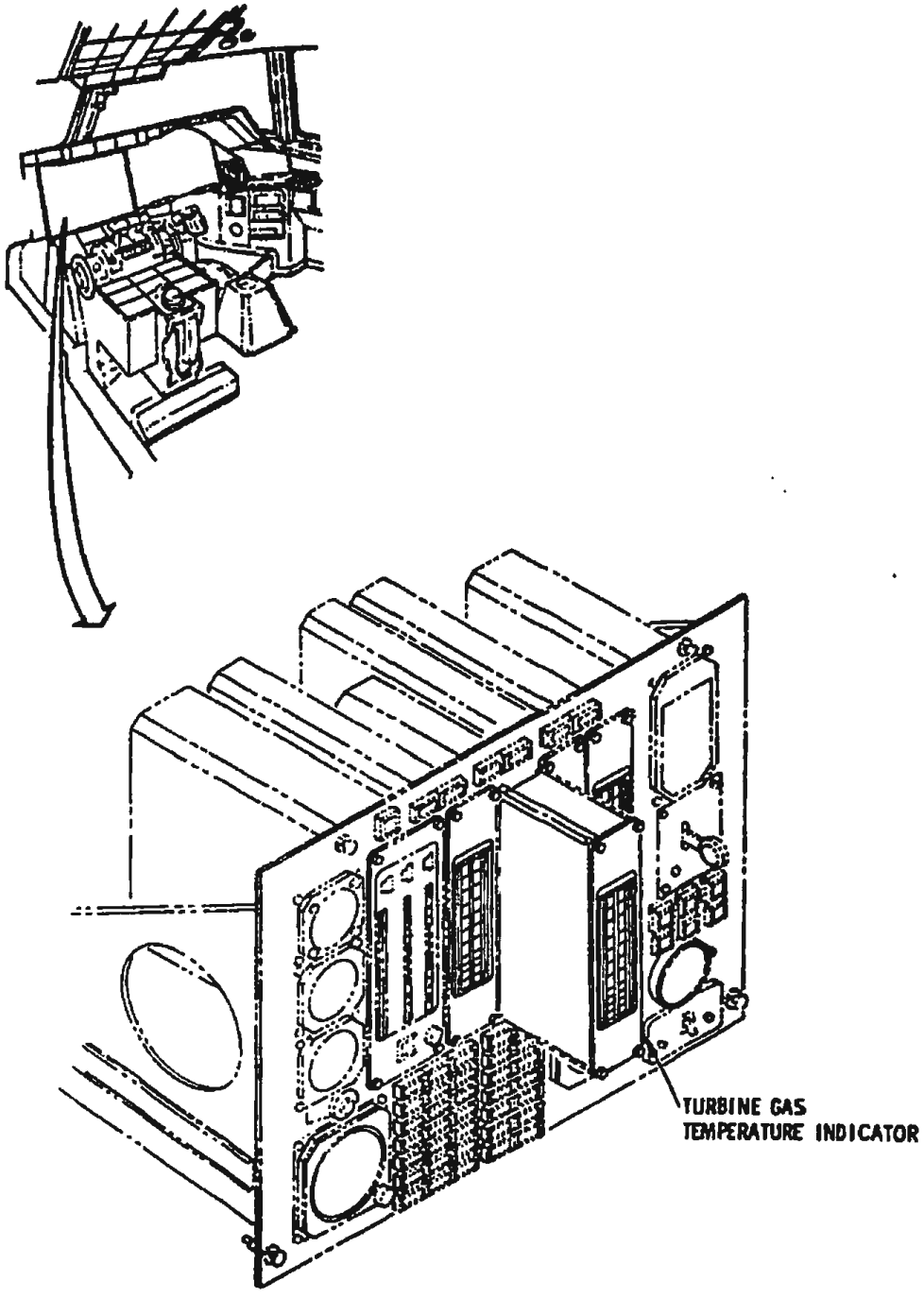
FIGURE	TITLE
101	Component Locator Index
102	Component Locator
103	TGT Indicator Fault Isolation
SCHEM 1	TGT Indicating System Circuits

COMPONENT	QTY	AREA/ACCESS	REFERENCE
TURBINE GAS TEMPERATURE (TGT) INDICATOR	1	FLT STATION/PILOT CENTER INST PANEL	77-21-03

M1-0000-77-199

R R Component Locator Index
Figure 101

R R 001B EFFECTIVITY: ALL

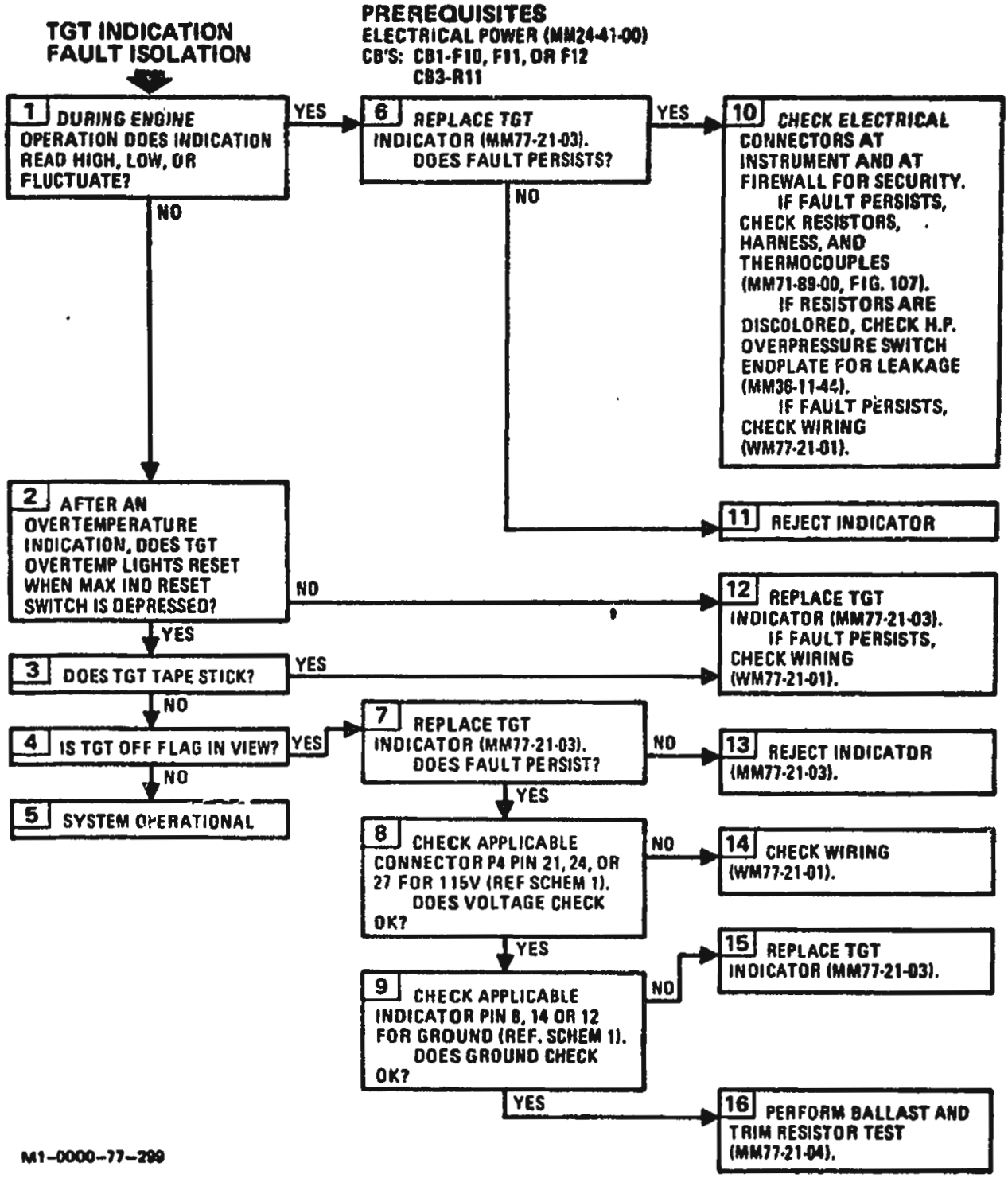


M1-0000-77-203

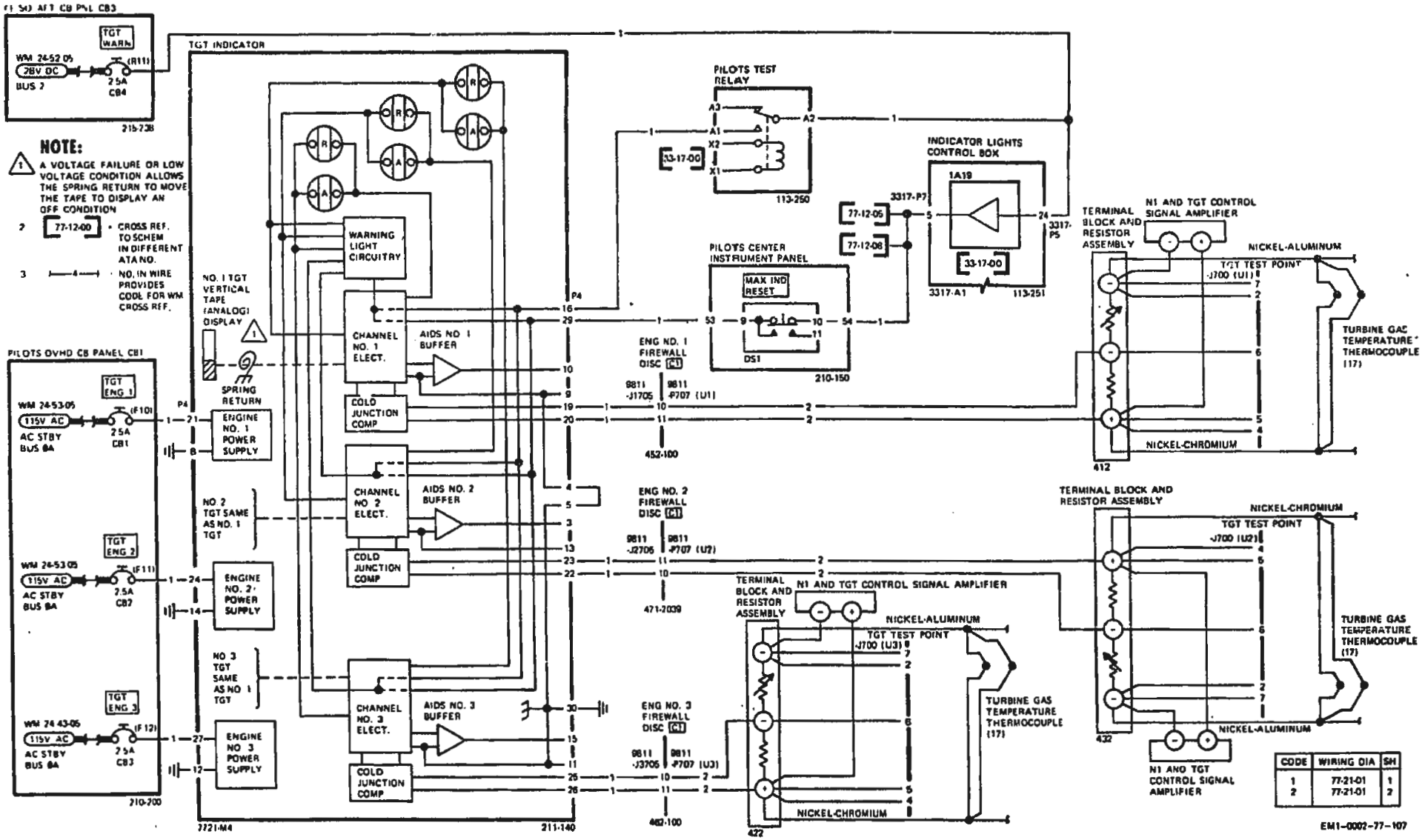
R
R

Component Locator
Figure 102

R EFFECTIVITY: ALL
R
001B


TGT INDICATION FAULT ISOLATION
PREREQUISITES
ELECTRICAL POWER (MM24-41-00)
CB'S: CB1-F10, F11, OR F12
CB3-R11
1 DURING ENGINE OPERATION DOES INDICATION READ HIGH, LOW, OR FLUCTUATE?
YES
NO
6 REPLACE TGT INDICATOR (MM77-21-03). DOES FAULT PERSISTS?
YES
NO
10 CHECK ELECTRICAL CONNECTORS AT INSTRUMENT AND AT FIREWALL FOR SECURITY. IF FAULT PERSISTS, CHECK RESISTORS, HARNESS, AND THERMOCOUPLES (MM71-89-00, FIG. 107). IF RESISTORS ARE DISCOLORED, CHECK H.P. OVERPRESSURE SWITCH ENDPLATE FOR LEAKAGE (MM36-11-44). IF FAULT PERSISTS, CHECK WIRING (WM77-21-01).
11 REJECT INDICATOR
2 AFTER AN OVERTEMPERATURE INDICATION, DOES TGT OVERTEMP LIGHTS RESET WHEN MAX IND RESET SWITCH IS DEPRESSED?
NO
YES
12 REPLACE TGT INDICATOR (MM77-21-03). IF FAULT PERSISTS, CHECK WIRING (WM77-21-01).
3 DOES TGT TAPE STICK?
YES
NO
4 IS TGT OFF FLAG IN VIEW?
YES
NO
7 REPLACE TGT INDICATOR (MM77-21-03). DOES FAULT PERSIST?
NO
13 REJECT INDICATOR (MM77-21-03).
YES
5 SYSTEM OPERATIONAL
8 CHECK APPLICABLE CONNECTOR P4 PIN 21, 24, OR 27 FOR 115V (REF SCHEM 1). DOES VOLTAGE CHECK OK?
NO
14 CHECK WIRING (WM77-21-01).
YES
9 CHECK APPLICABLE INDICATOR PIN 8, 14 OR 12 FOR GROUND (REF. SCHEM 1). DOES GROUND CHECK OK?
NO
15 REPLACE TGT INDICATOR (MM77-21-03).
YES
16 PERFORM BALLAST AND TRIM RESISTOR TEST (MM77-21-04).
M1-0000-77-289

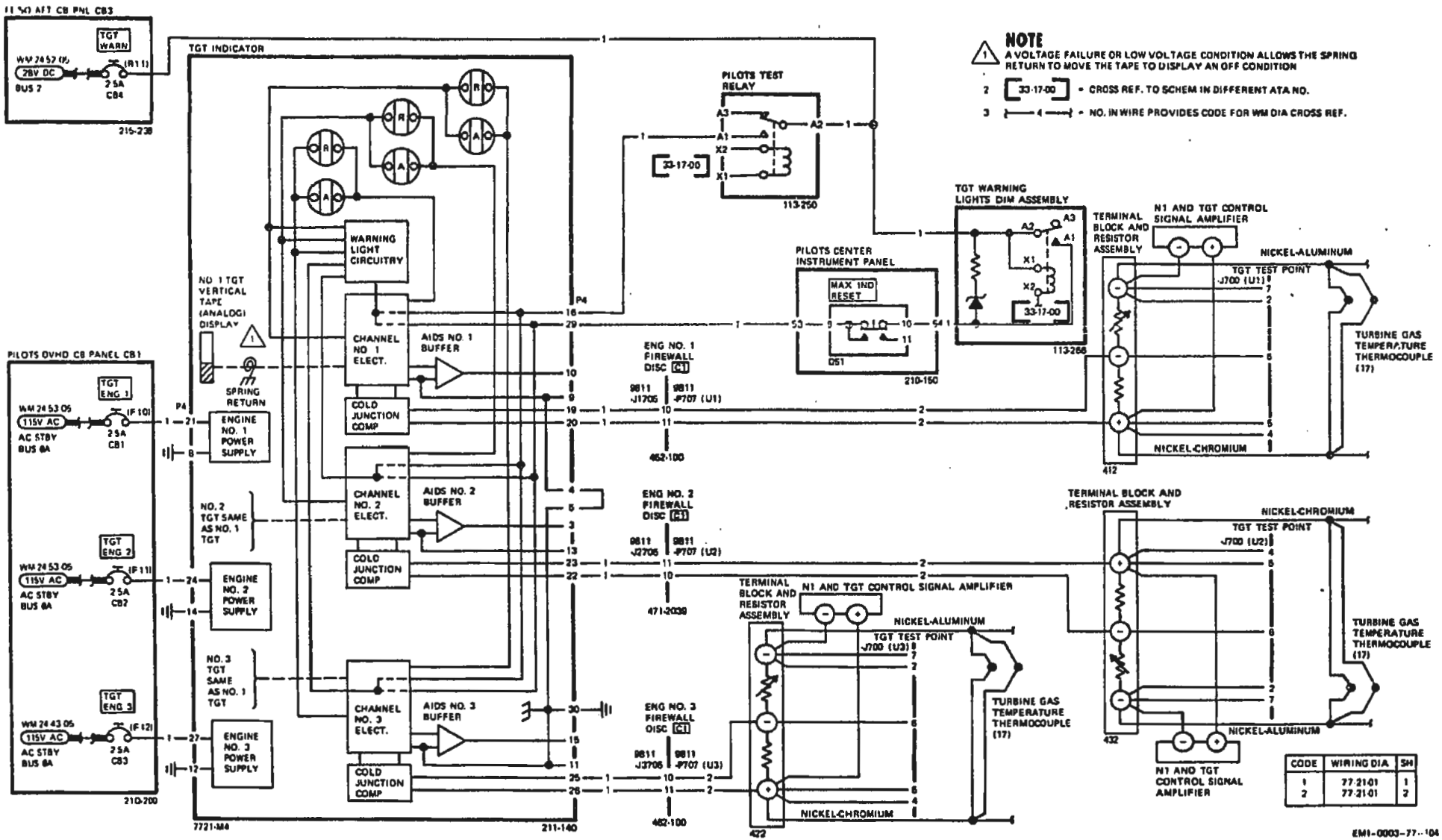
R TGT Indication System Fault Isolation
R Figure 103



R TGT Indicating System Circuits
R SCHEM 1

EFFECTIVITY: 001-006 WITHOUT SB33-020

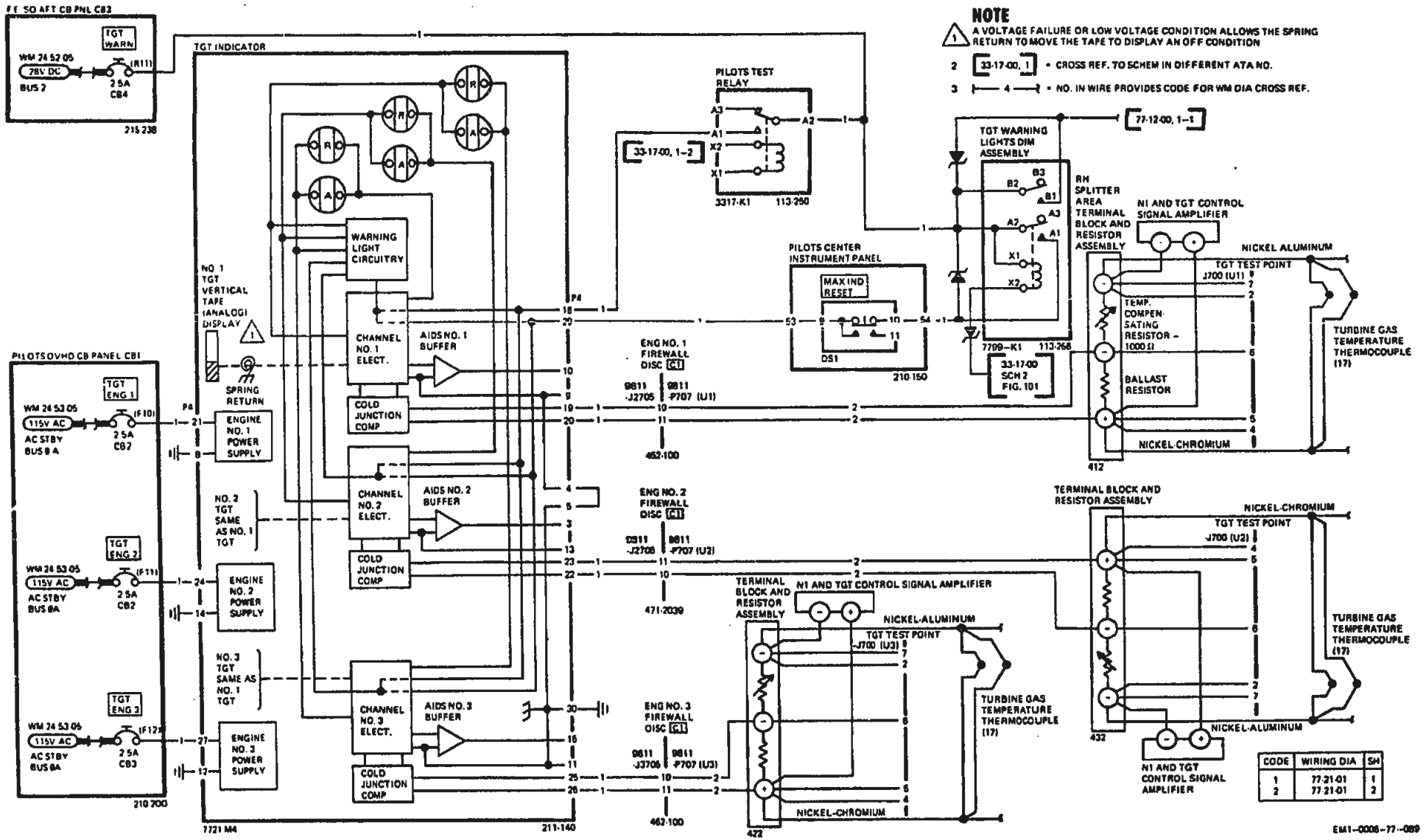
001B



R TGT Indicating System Circuits
R SCHEM 1

EFFECTIVITY: 008-023 WITHOUT SB33-020

001B


NOTE
A VOLTAGE FAILURE OR LOW VOLTAGE CONDITION ALLOWS THE SPRING RETURN TO MOVE THE TAPE TO DISPLAY AN OFF CONDITION
2 33-17-00, 1 • CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
3 4 • NO. IN WIRE PROVIDES CODE FOR WM DIA CROSS REF.
TGT INDICATOR
PILOTS TEST RELAY
TGT WARNING LIGHTS DIM ASSEMBLY
RH SPLITTER AREA TERMINAL BLOCK AND RESISTOR ASSEMBLY
N1 AND TGT CONTROL SIGNAL AMPLIFIER
PILOTS CENTER INSTRUMENT PANEL
MAX IND RESET
WARNING LIGHT CIRCUITRY
CHANNEL NO. 1 ELECT.
CHANNEL NO. 2 ELECT.
CHANNEL NO. 3 ELECT.
AIDS NO. 1 BUFFER
AIDS NO. 2 BUFFER
AIDS NO. 3 BUFFER
COLD JUNCTION COMP
NO. 1 TGT VERTICAL TAPE (ANALOG) DISPLAY
SPRING RETURN
NO. 2 TGT SAME AS NO. 1 TGT
NO. 3 TGT SAME AS NO. 1 TGT
ENGINE NO. 1 POWER SUPPLY
ENGINE NO. 2 POWER SUPPLY
ENGINE NO. 3 POWER SUPPLY
ENG NO. 1 FIREWALL DISC C1
ENG NO. 2 FIREWALL DISC C1
ENG NO. 3 FIREWALL DISC C1
TERMINAL BLOCK AND RESISTOR ASSEMBLY
TEMP. COMPENSATING RESISTOR - 1000 Ω
BALLAST RESISTOR
NICKEL-ALUMINUM
NICKEL-CHROMIUM
TGT TEST POINT
TURBINE GAS TEMPERATURE THERMOCOUPLE (17)
CODE WIRING DIA SH
1 77-21-01 1
2 77-21-01 2

R TGT Indicating System Circuits
R SCHEM 1

EFFECTIVITY: 001-023 WITH SB33-020 AND 024-999

0018

TURBINE GAS TEMPERATURE (TGT) INDICATING SYSTEM ADJUSTMENT AND TEST

1. Equipment and Materials

Test Set A, Rolls-Royce Ltd., PN 3501619 (Smith's No. 5X/173 BTE), or equivalent

Test Set, Rolls-Royce Ltd., PN1702259 (Smith's No. 5X/173BTE/1), or equivalent

Test Set, Rolls-Royce Ltd., PN1702267 (Smith's No. 5X/173BTE/2), or equivalent

Amplifier Test Set, Rolls-Royce Ltd., PN UT.1000, or equivalent

Amplifier Test Set, Rolls-Royce Ltd., PN UT.1000/1, or equivalent

Lead, Rolls-Royce Ltd., PN UT.937/1, or equivalent

Lead, Rolls-Royce Ltd., PN UT.997, or equivalent

Lead, Rolls-Royce Ltd., PN UT.998, or equivalent

Lead, Rolls-Royce Ltd., PN UT.1144, or equivalent

Lead, Rolls-Royce Ltd., PN UT.1124/1, or equivalent

Carrying Case, Rolls-Royce Ltd. PN U999127, or equivalent

Test leads and hose, Rolls-Royce Ltd., PN 1702218 (Smith's No. 1X/195BTE), or equivalent

Test leads and hose, Rolls-Royce Ltd., PN1702260 (Smith's No. 2X/195 BTE), or equivalent

Test leads and hose, Rolls-Royce Ltd., PN1702268, or equivalent

R Test Set, Rolls-Royce Ltd., PN 1702372 (Smiths 4001-KTQ-1), or
R equivalent

R Test Set, Rolls-Royce Ltd., PN 1702410 (Smiths 4002-KTQ-1), or
R equivalent

R Power Lead, Rolls-Royce Ltd., PN 1702389 (Smiths 0101-KCQ-40),
R or equivalent

R Test Lead, Rolls-Royce Ltd., PN 1702390 (Smiths 0106-KCQ-40), or
R equivalent

R Test Lead, Rolls-Royce Ltd., PN 1702391 (Smiths 0107-KCQ-40), or equivalent

Splitter Area Access Work Platform, Rolls-Royce Ltd., PN CP20309, or equivalent

Wheatstone bridge

Insulation test meter (capable of testing insulation resistance at 7.5 to 15 volts)

2. Referenced Procedures

24-41-00	External Power/Ground Service System - Maintenance Practices
71-11-00	LH Hinged Cowl - Servicing
71-12-05	LH and RH Upper Hinged Cowl - Servicing
72-03-00	Gas Generator Fairings - Maintenance Practices
77-21-04	TGT Electrical Cable and Terminal Block - Maintenance Practices
78-30-00	Thrust Reverser - Maintenance Practices

3. Adjustment/Test

CAUTION: ENSURE ELECTRICAL CONNECTORS ARE FREE FROM SOLID OR LIQUID CONTAMINATION BEFORE CONNECTING AND DISCONNECTING. FAILURE TO DO SO CAN RESULT IN A FIRE.

A. TGT Indicator Functional Test - Using Amplifier Test Sets UT.1000, UT.1000/1, or UT.1000/2

(1) Open applicable LH hinged cowl 413A or 423A for engines No. 1 and 3 (Ref. 71-11-00) or 433DL for engine No. 2 (Ref. 71-12-05).

(2) Prepare for testing (test set UT.1000).

(a) Remove test set cover and connect test set to engine test connectors (Ref. Fig. 501, Sheet 1).

(b) Turn on electrical power (Ref. 24-41-00).

(c) Select test set power supply switch to ON and verify that POWER indicator light comes on (Ref.

Fig. 502, Sheet 1). Allow two minutes for test set to stabilize.

(d) Turn T7 INJECT knobpot fully counterclockwise.

(e) Select N1/REDATUM switch to N1.

(f) Select N1 INJECT switch to OFF.

(g) Select T7 INJECT switch to ON.

(h) Select SPEED/TEMP. switch to TEMP.

(j) Select NORMAL/BALLASTED switch to BALLASTED.

(3) Prepare for testing (test set UT.1000/1 or UT.1000/2).

(a) Remove test set cover.

(b) Connect test set to engine test connectors (Ref. Fig. 501, Sheet 2).

(c) Turn on electrical power (Ref. 24-41-00).

(d) Select test set power supply switch to ON and verify that POWER indicator light comes on (Ref. Fig. 502, Sheet 2). Allow two minutes for test set to stabilize.

(e) Turn T7 INJECT knobpot fully counterclockwise.

(f) Select REDATUM switch to OFF (center position).

(g) Select N1/N2 INJECT switch to N1.

(h) Select T7 INJECT switch to ON.

(j) Select SPEED/TEMP switch to TEMP.

(k) Select NORMAL/BALLASTED switch to BALLASTED.

(4) Turn temperature scale control until temperature scale reads 410 degrees C (Ref. Fig. 502, Sheet 1 or 2).

(5) Turn T7 INJECT knobpot clockwise to center zero GALVO.

(6) Verify that applicable flight station TGT indicator reads 410 (±10) degrees C.

(7) Turn temperature scale control until temperature scale reads 670 degrees C.

(8) Turn T7 INJECT knobpot to center zero GALVO.

(9) Verify that applicable flight station TGT indicator reads 670 (±5) degrees C.

(10) Turn temperature scale control until temperature scale reads 710 degrees C.

(11) Turn T7 INJECT knobpot to center zero GALVO.

(12) Verify that applicable flight station TGT indicator reads 710 (±5) degrees C.

(13) Turn T7 INJECT knobpot fully counterclockwise and select power supply switch OFF.

(14) Turn off electrical power (Ref. 24-41-00).

(15) Disconnect leads from engine and test set. Install dust covers to all connectors.

(16) Install test set cover.

(17) Close LH hinged cowl.

B. TGT Indicator Functional Test - Using Test Set 3501619 (Smith's No. 5X/173 BTE), Test Set 1702259 (Smith's No. 5 X/173 BTE/1), or Test Set 1702267 (Smith's No. 5X/173 BTE/2)

(1) Open applicable LH hinged cowl 413A or 423A for engines No. 1 and 3 (Ref. 71-11-00) or 433DL for engine No. 2 (Ref. 71-12-05).

(2) Connect test set to engine test connectors (Ref. Fig. 503 Sheet 1, 2, or 3).

(3) Turn on electrical power (Ref. 24-41-00).

(4) Select test set POWER SUPPLY switch ON and allow two minutes for the set to stabilize (Ref. Fig. 504, Sheet 1, 2, or 3).

(5) Press BATTERY STATE switch and verify that green light comes on.

(6) Set DISPLAY selector to CHECK ZERO and check digital display reads 00000 ± 1.

NOTE: If reading is not within limits, adjust SET ZERO adjusting screw.

(7) Set DISPLAY selector to CHECK 10000 and check digital display reads 10000 ± 5.

NOTE: If reading is not within limits, adjust SET 10000 adjusting screw. Then turn Datum select switch to OFF (center position).

(8) Select and hold BALLASTED switch in BALLASTED TGT position.

(9) Select DISPLAY selector to INJECT T7.

(10) Turn T7 INJECTOR clockwise until DISPLAY reads 410 degrees C. Verify that applicable flight station TGT indicator reads 410 (±10) degrees C.

(11) Turn T7 INJECTOR clockwise until DISPLAY reads 670 degrees C. Verify that flight station TGT indicator reads 670 (±5) degrees C.

(12) Turn T7 INJECTOR clockwise until DISPLAY reads 710 degrees C. Verify that flight station TGT indicator reads 710 (±5) degrees C.

(13) Select POWER SUPPLY switch to OFF.

(14) Turn off electrical power (Ref. 24-41-00).

(15) Disconnect test leads from engine and test set. Install dust covers to all connectors.

(16) Close LH hinged cowl.

R C. TGT Indicator Functional Test - Using Amplifier Test Sets
R Smiths 4001 or 4002-KTQ-1

R (1) Open left-hand hinged cowl 413A or 423A for engines No.
R 1 and 3 (Ref. 71-11-00) or 433DL for engine No. 2 (Ref.
R 71-12-05).

R (2) Prepare for testing

R (a) Connect test leads 0101-KCQ, 0106-KCQ and 0107-KCQ
R as shown (Ref. Fig. 506).

R (b) Ensure switches (10) and (15) are set to off (Ref.
R Fig. 507).

R (c) Ensure N INJECTOR (12) is set fully
R counter-clockwise.

R (d) Turn on electrical power (Ref. 24-41-00).

R (e) Select power supply switch (7) to ON and allow 2
R minutes for set to stabilize.

R (f) Set selector (16) to DISPLAY TEST. Check DISPLAY
R (8) runs through the complete digit sequence 00000
R to 99999 then 8.8.8.8.8. and displays (13) and
R (14) traverse red through the complete range.

R (3) Ensure T INJECTOR 17 is set fully counter-clockwise
R (Ref. Fig. 507).

R (4) Set switch (9) to INJECT.

R (5) Set switch (10) to BALLASTED.

R (6) Set DISPLAY selector to INJECT T7.

R (7) Turn T7 INJECTOR clockwise until DISPLAY reads 410
R deg.C. Check flight station indicator reads between
R 400 and 420 deg.C.

R (8) Turn T7 INJECTOR clockwise until DISPLAY reads 670
R deg.C. Check flight station indicator reads between
R 665 and 675 deg.C.

R (9) Turn T7 INJECTOR clockwise until DISPLAY reads 710
R deg.C. Check flight station indicator reads between
R 705 and 715 dec.C.

R (10) Turn T7 INJECT knobpot fully counter-clockwise.

R (11) Set Power supply switch to OFF.

R (12) Turn off electrical power (Ref. 24-41-00).

R (13) Disconnect test leads from engine and test set.
R Install dust covers on all connectors (Ref. Fig. 506,
R 507, or 508).

R (14) Install test cover.

R (15) Close left-hand hinged cowl 413A or 423A for engines
R No. 1 and 3 (Ref. 71-11-00) or 433DL for engine No. 2
R (Ref. 71-12-05).

R D. Circuit and Insulation Resistance Test - Thermocouple to Terminal Block

WARNING: ENSURE THRUST REVERSER SYSTEM IN LOCKED IN FORWARD THRUST POSITION WHILE WORK IS IN PROGRESS.

Deactivate and tag thrust reverser and associated systems, and install thrust reverser locks (Ref. 78-30-00).

(1) Test circuit resistance as follows:

(a) Remove ballast resistor, trim resistor and lead terminals from terminal block (Ref. 77-21-04).

(b) Connect test leads, of known resistance value, to thermocouple extension cables.

NOTE: Test leads must be connected directly to leads under test by nuts and bolts. Probes or crocodile clips are not satisfactory.

(c) Connect Wheatstone bridge to test leads.

(d) Measure resistance of system. After subtracting resistance value of test leads, resistance must be 0.866 to 0.878 ohms - including the resistance of the 30-33 in. (762.0-838.2mm) harness to junction box extension leads which is 0.19 ohms at 20 degrees C.

(e) Disconnect test leads from thermocouple extension cables.

(f) Install ballast resistor, trim resistor and lead terminals to terminal block (Ref. 77-21-04).

(2) Test insulation resistance as follows:

(a) Position spacer and side pieces in cold stream duct.

(b) Remove front pylon fairing R.H. access panel 418BR5 or 428BR5 for engine No. 1 and 3, or 438BR5 for engine No. 2 (Ref. 72-03-00).

(c) Remove securing nuts from terminal posts 1 and 3 of the terminal block then remove T7 AMP leads from terminal posts and refit securing nuts (Ref. 77-21-04).

WARNING: THE T7 AMP LEADS MUST NOT BE CONNECTED TO THE TERMINAL BLOCK WHILE THE FOLLOWING TESTS ARE CARRIED OUT.

(d) Using an insulation test meter, test each terminal post with respect to ground. The resistance must not be less than 10000 ohms in each case.

(e) Remove securing nuts from terminal posts 1 and 3 and install T7 AMP leads then install securing nuts (Ref. 77-21-04).

(f) Install front pylon fairing R.H. access panel 418BR5 or 428BR5 for engines No. 1 and 3 or 438BR5 for engine No. 2 (Ref. 72-03-00).

(g) Remove spacer and side pieces from cold stream duct.

(h) Unlock and reactivate thrust reverser and associated systems (Ref. 78-30-00).

R E. Circuit and Insulation Resistance Test - Thermocouple and Harness

WARNING: DO NOT ENTER COLD STREAM NOZZLE UNTIL THRUST REVERSER IS LOCKED IN FORWARD THRUST POSITION.

(1) Lock thrust reverser system in forward-thrust position (Ref. 78-30-00).

(2) On pilots overhead circuit breaker panel CB1, zone 210, open and tag applicable circuit breaker ENGINE START CONT (E13, E14, or D15).

(3) Position splitter area access work platform in cold stream collector nozzle, zone 435.

(4) Remove interservices fairing left-hand rear access panel (Ref. 72-03-00).

(5) Remove center and left-hand nozzle box access panels.

(6) Disconnect thermocouple extension cables from thermocouple harness (Ref. Fig. 505).

(7) Test circuit resistance as follows:

(a) Connect test leads of known resistance value to thermocouple harness.

NOTE: Test leads must be connected directly to the leads under test by nuts and bolts. Probes or crocodile clips are not satisfactory.

(b) Connect Wheatstone bridge to test leads.

(c) Measure resistance of harness and thermocouples. After subtracting value of test leads, the resistance should be 0.676 to 0.688 ohms.

(d) Disconnect Wheatstone bridge and test leads.

(e) Connectthermocouple extension cables to thermocouple harness.

(8) Test insulation resistance as follows:

(a) Disconnect thermocouple extension cables from thermocouple harness. Using insulation test meter, test each leg of harness with respect to ground. The resistance must not be less than 10,000 ohms in each case.

(b) Disconnect insulation test meter.

(9) Connect thermocouple extension cables to thermocouple harness.

(10) Install left-hand and center nozzle box access panels.

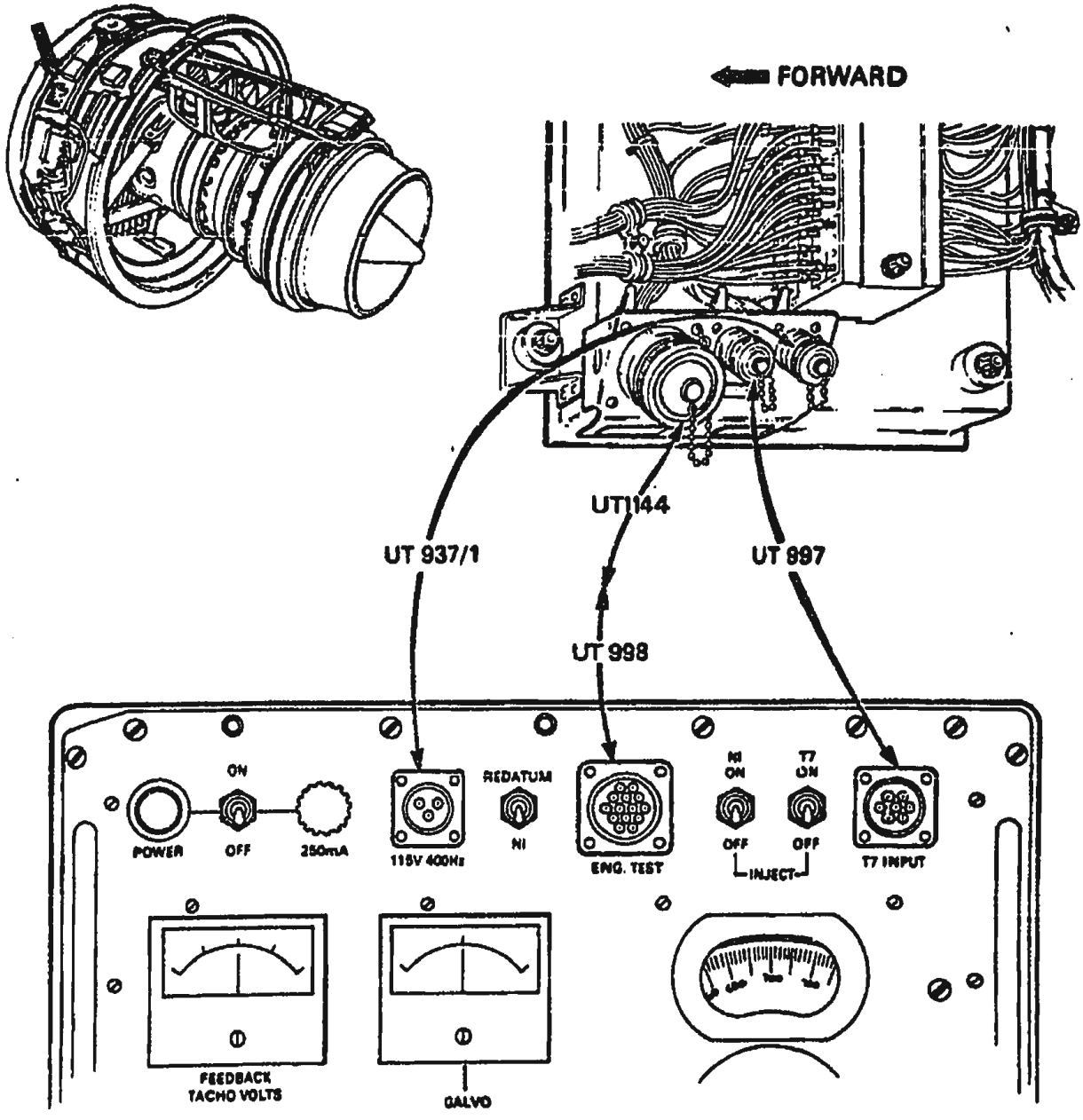
(11) Install interservices fairing left-hand rear access panel.

(12) Remove work platform from cold stream collector nozzle.

(13) Unlock thrust reverser system (Ref. 78-30-00).

(14) Remove tags and close circuit breakers opened in Step 3D(2).

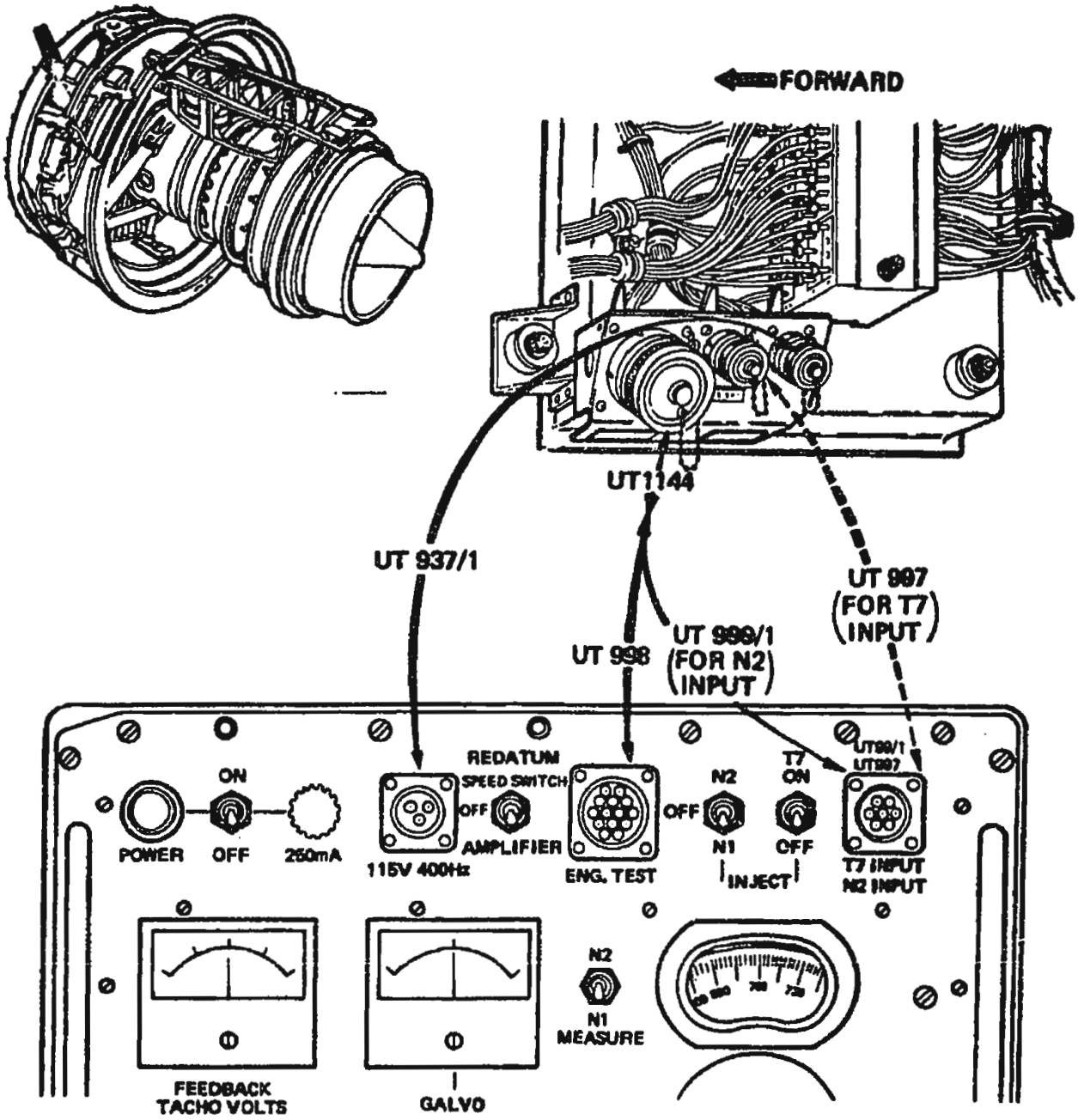
(15) On next engine run observe turbine gas temperature indications for required temperatures.



TEST SET UT. 1000

M1-0101-77-607
31611

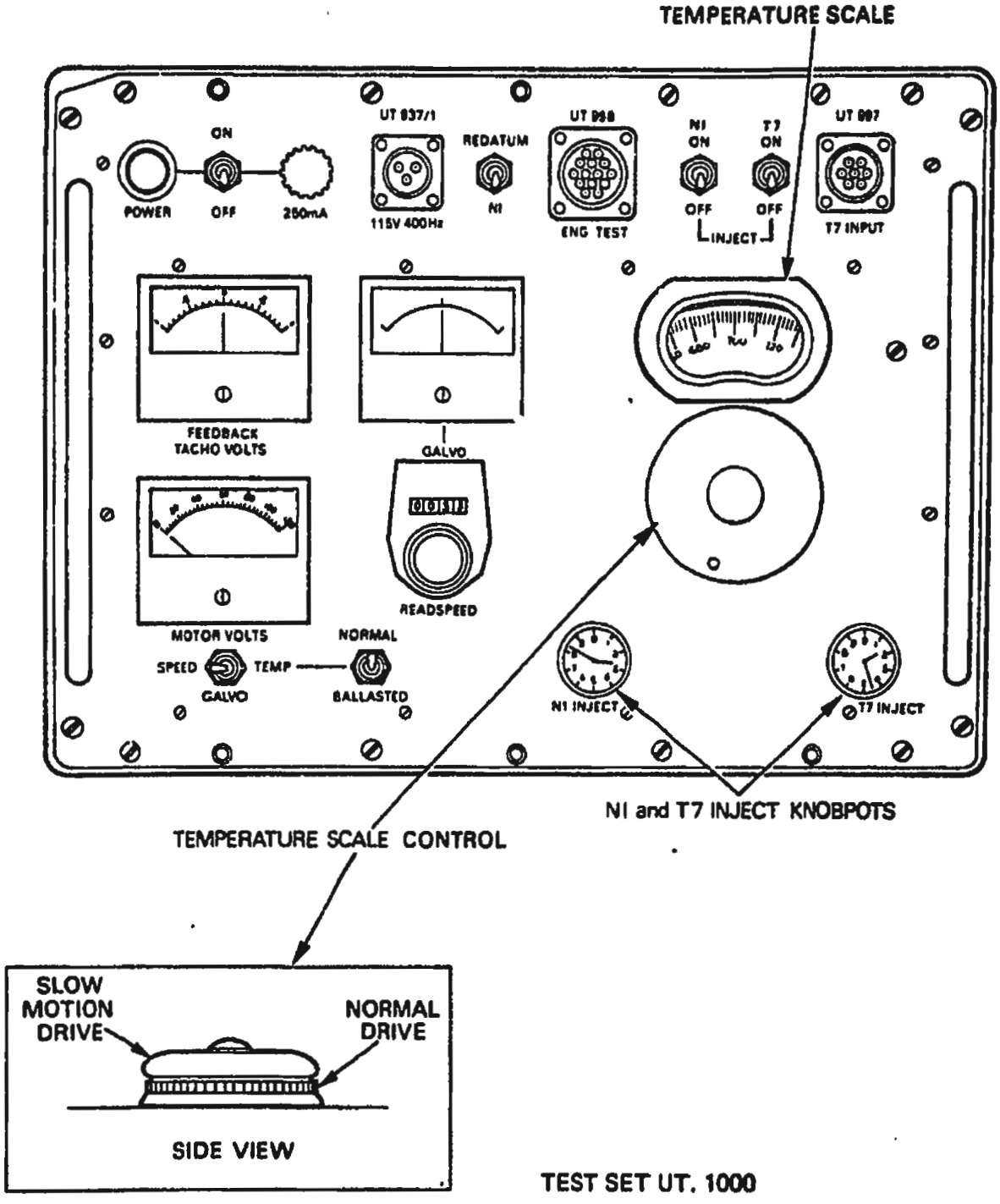
Amplifier Test Set to Engine Connections
Figure 501 (Sheet 1)



TEST SET UT.1000/1
OR
TEST SET UT.1000/2

M1-0101-71-572

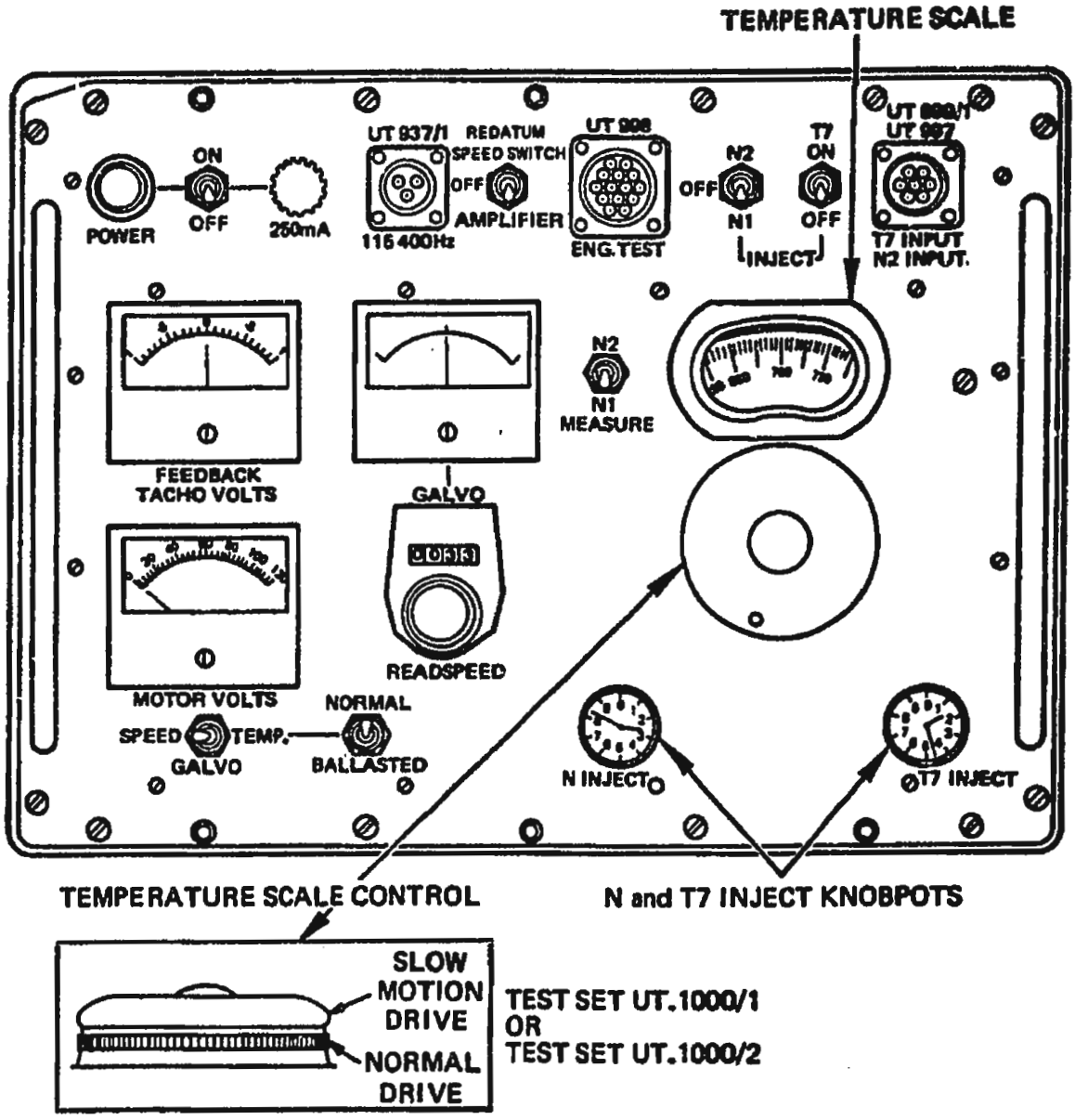
Amplifier Test Set to Engine Connections
Figure 501 (Sheet 2)



TEST SET UT. 1000

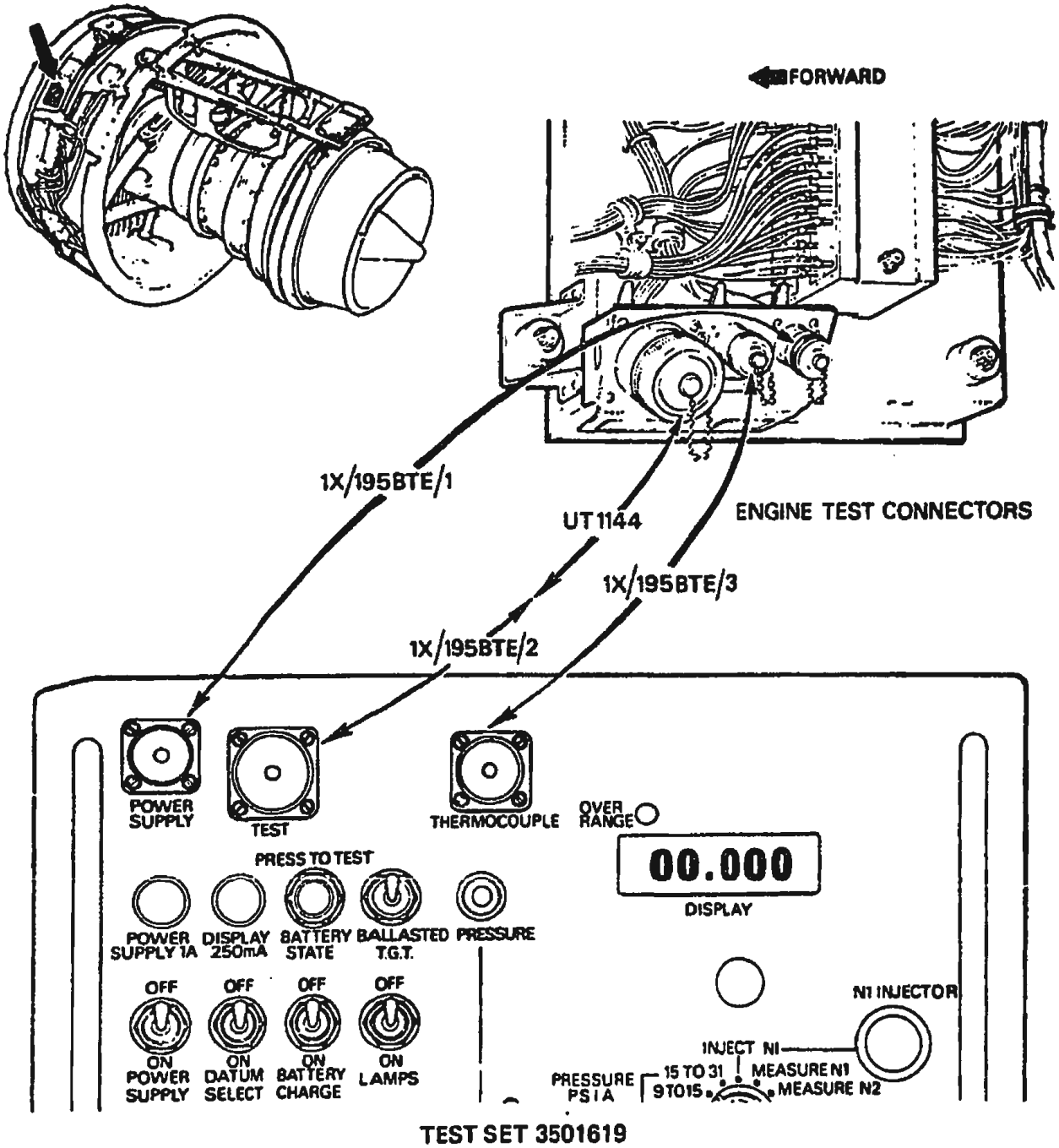
M1-0101-77-508
32014

Amplifier Test Set Front Panel
Figure 502 (Sheet 1)



M1-0101-71-673

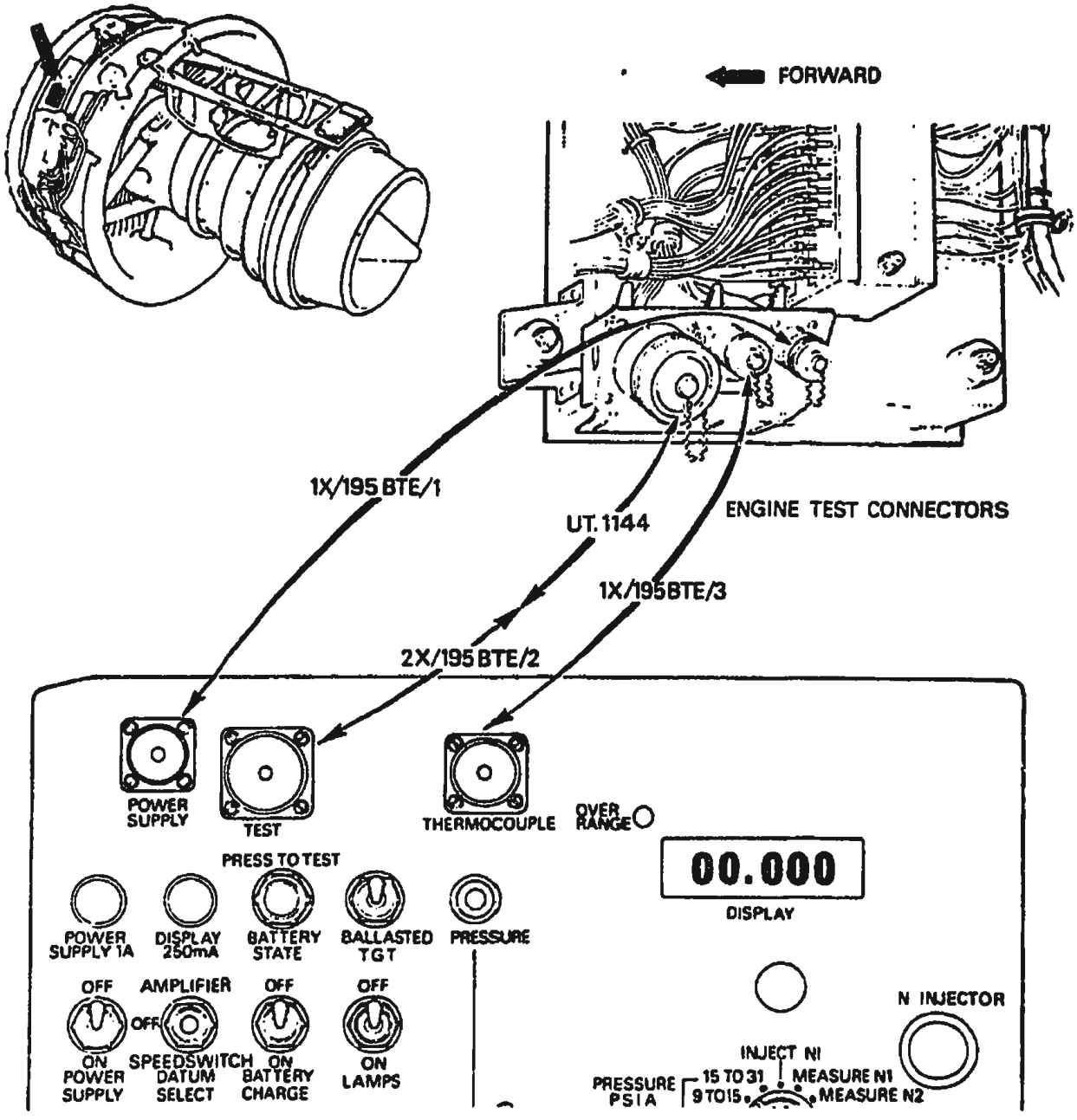
Amplifier Test Set Front Panel
Figure 502 (Sheet 2)



TEST SET 3501619

M1-0102-77-509
31613A

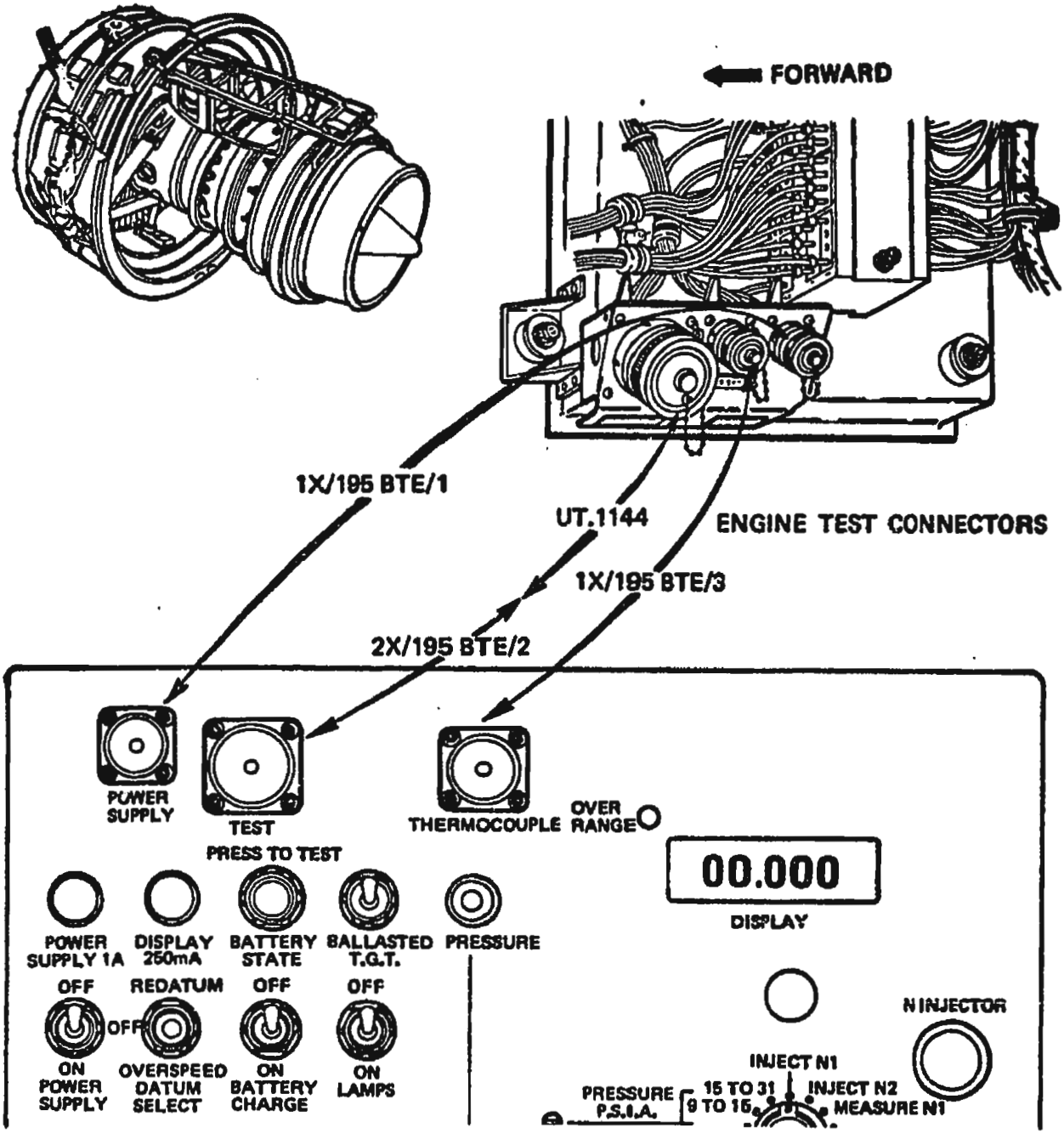
Test Set Connections
Figure 503 (Sheet 1)



TEST SET 1702259

M1-0100-77-821
32121A

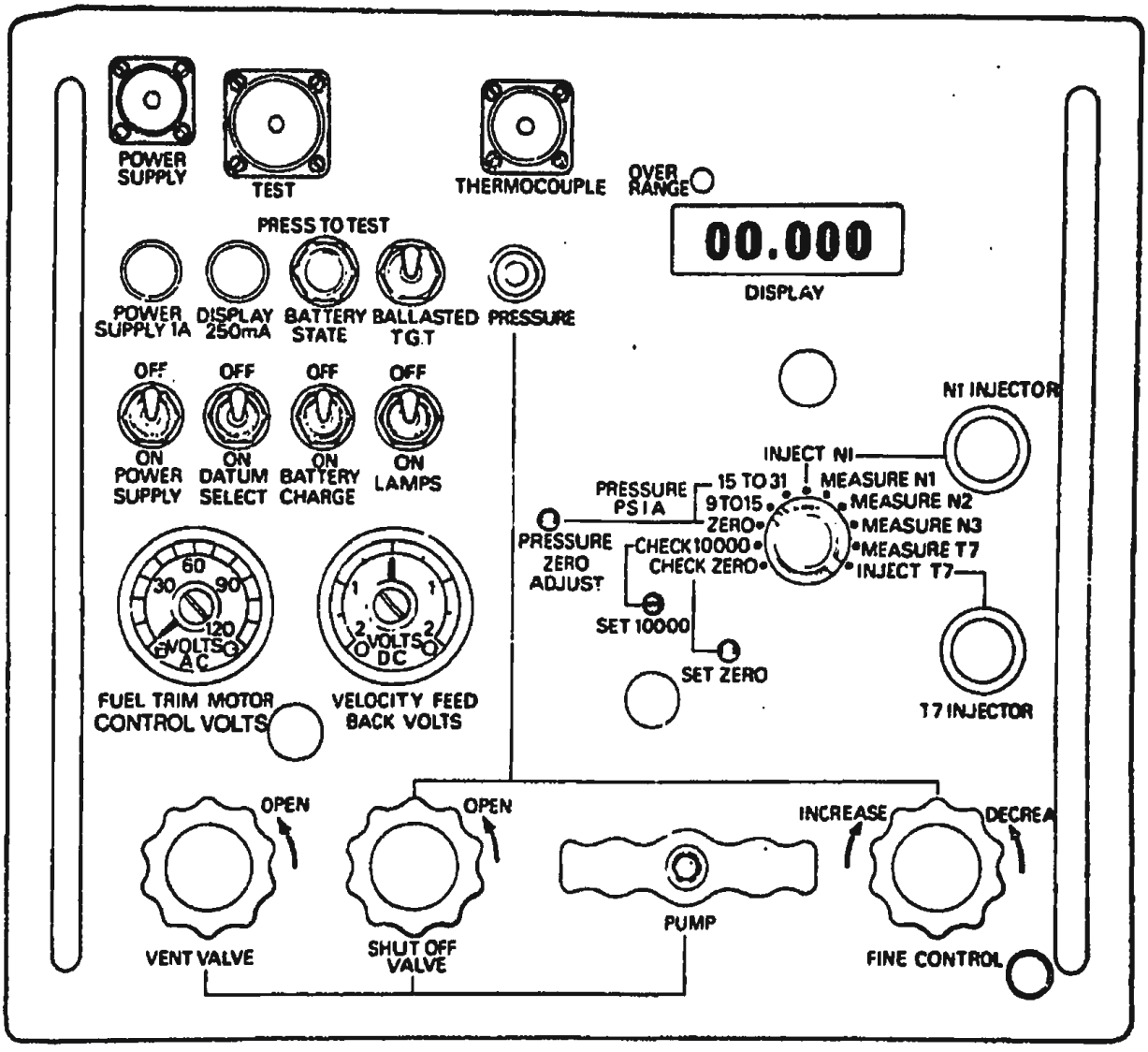
Test Set Connections
Figure 503 (Sheet 2)



TEST SET
1702287

M1-0100-71-582
35027

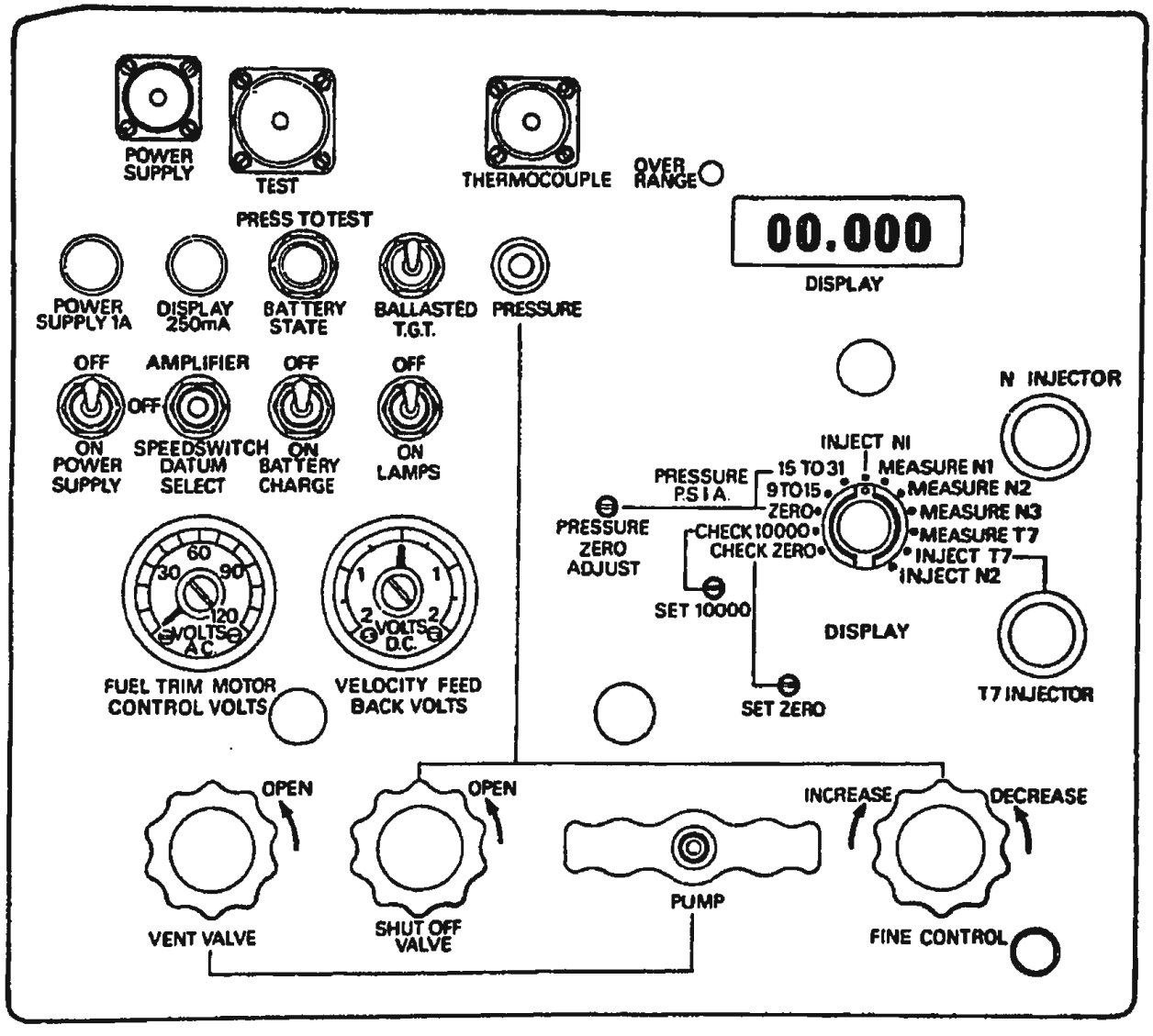
Test Set Connections
Figure 503 (Sheet 3)



TEST SET 3501619

M1-0102-77-510
31814

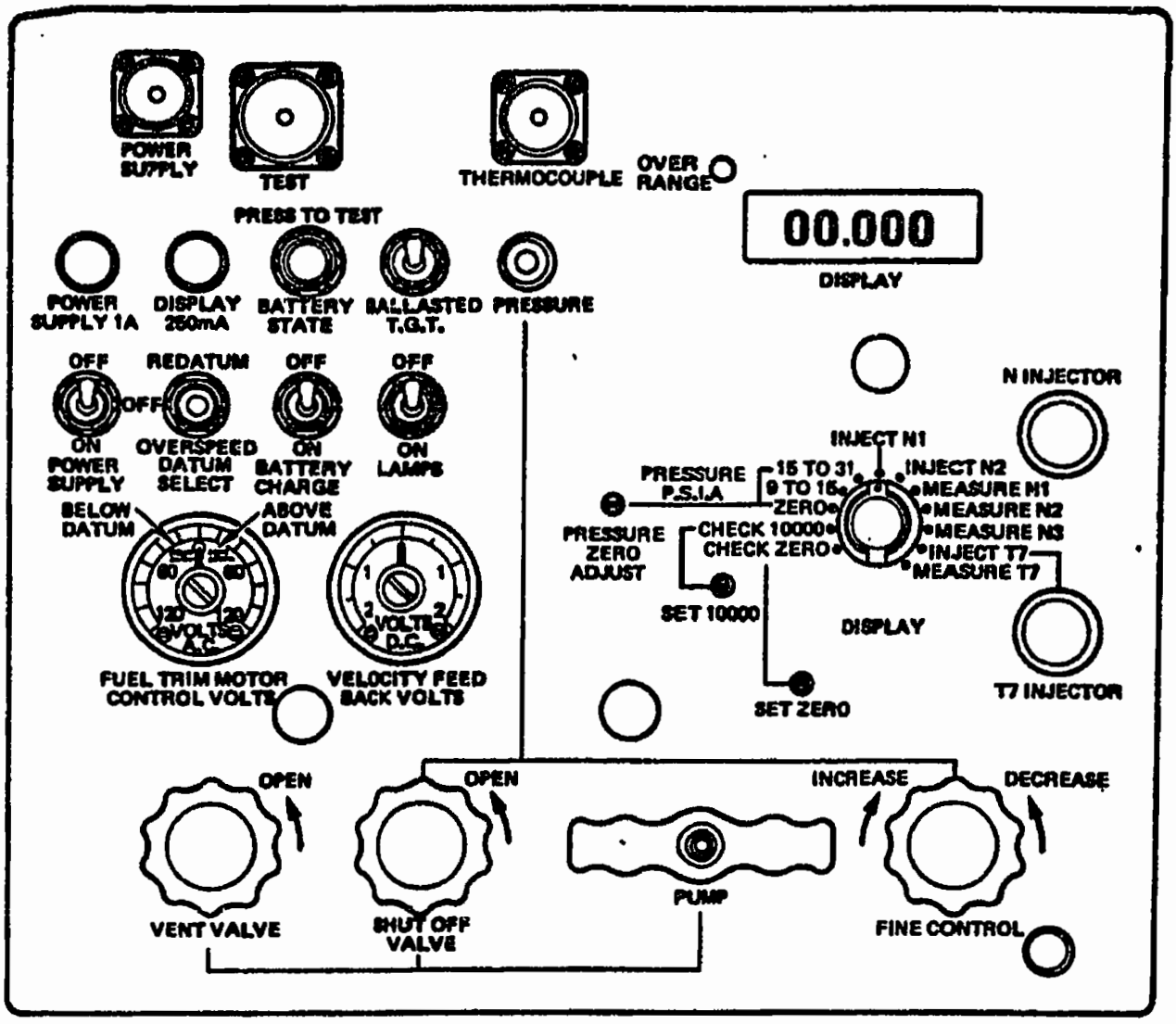
Test Set Front Panel
Figure 504 (Sheet 1)



TEST SET 1702259

M1-0100-77-822
32120

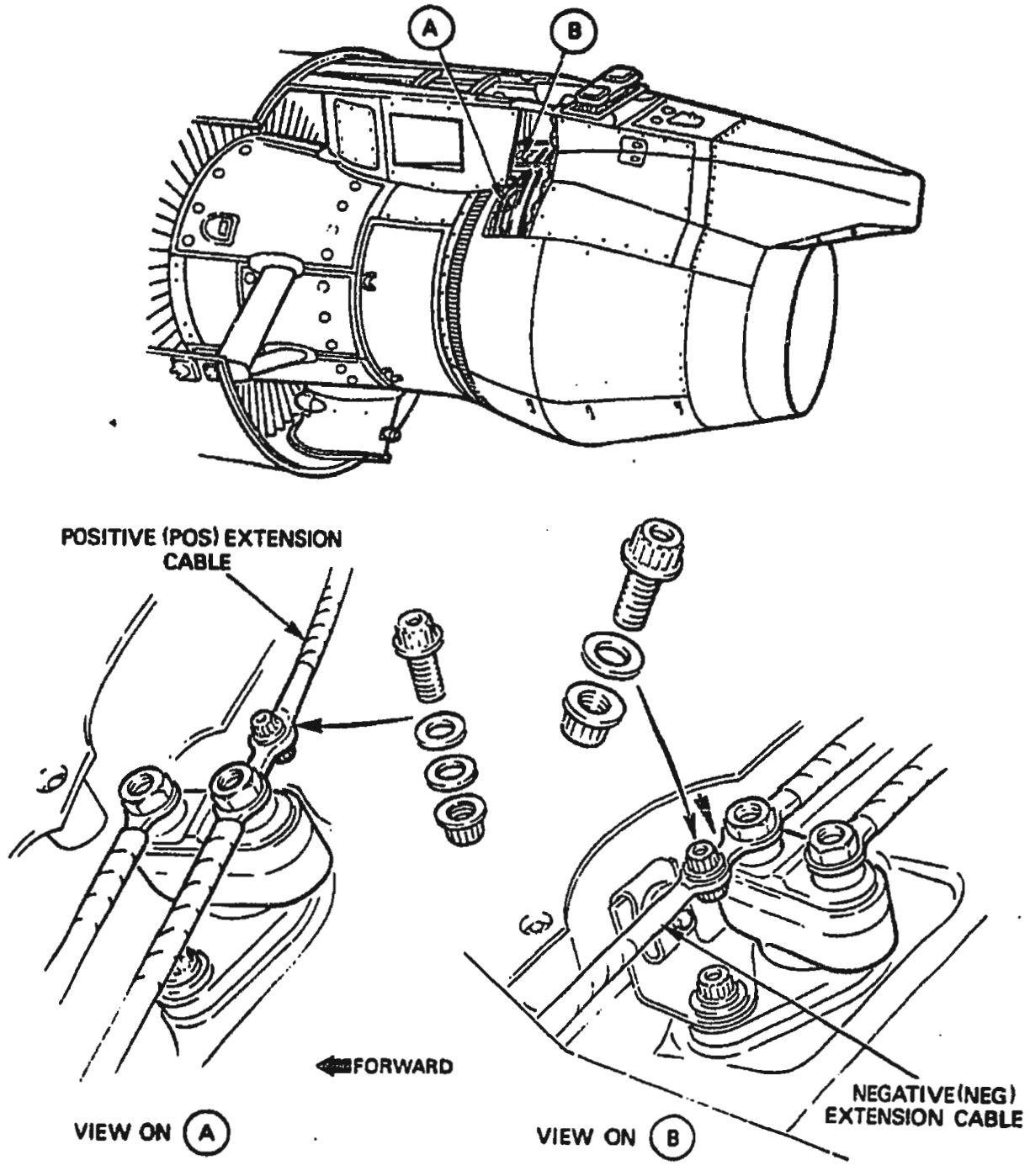
Test Set Front Panel
Figure 504 (Sheet 2)



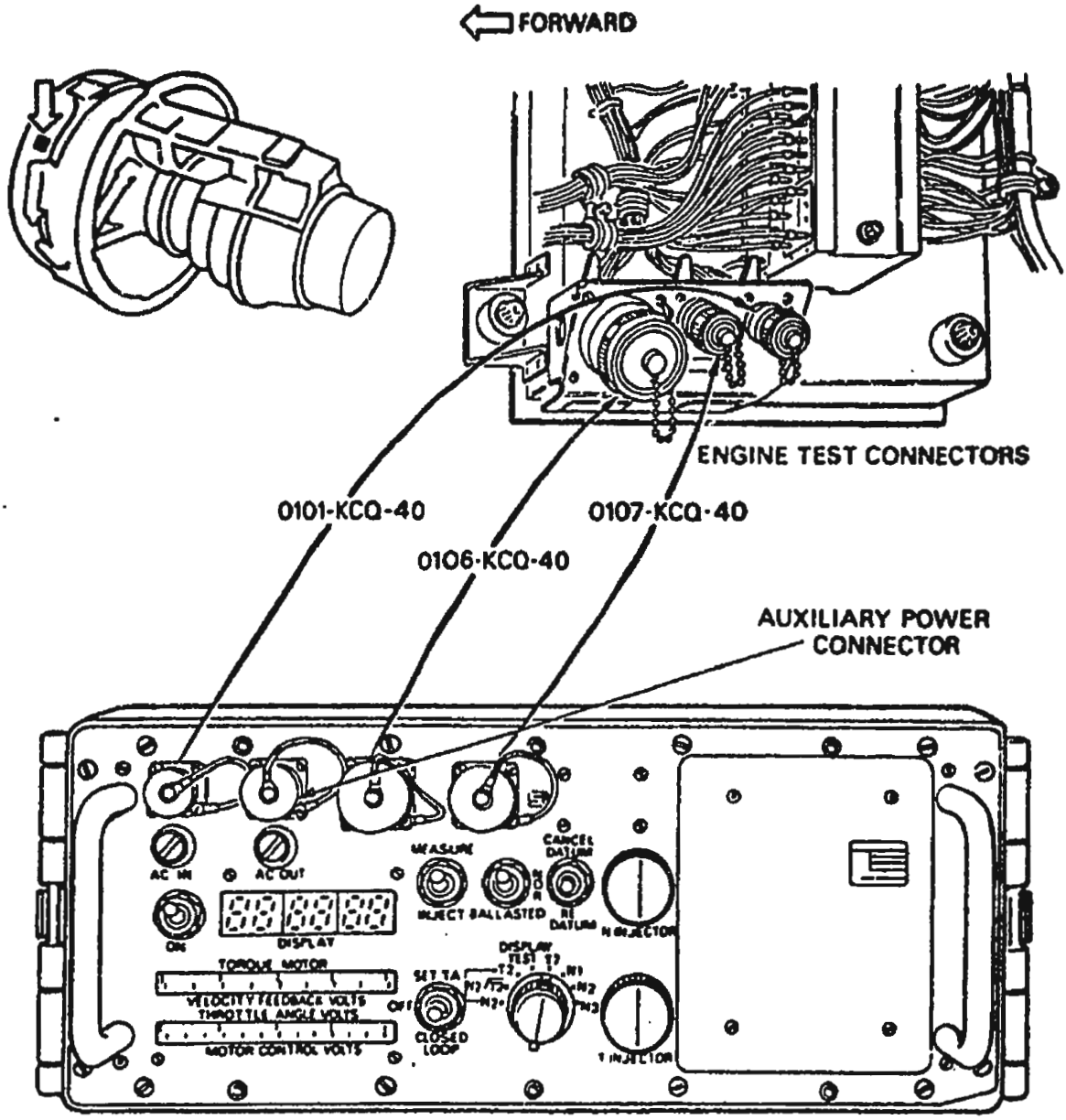
TEST SET
1702287

M1-0100-71-583
35028

Test Set Front Panel
Figure 504 (Sheet 3)

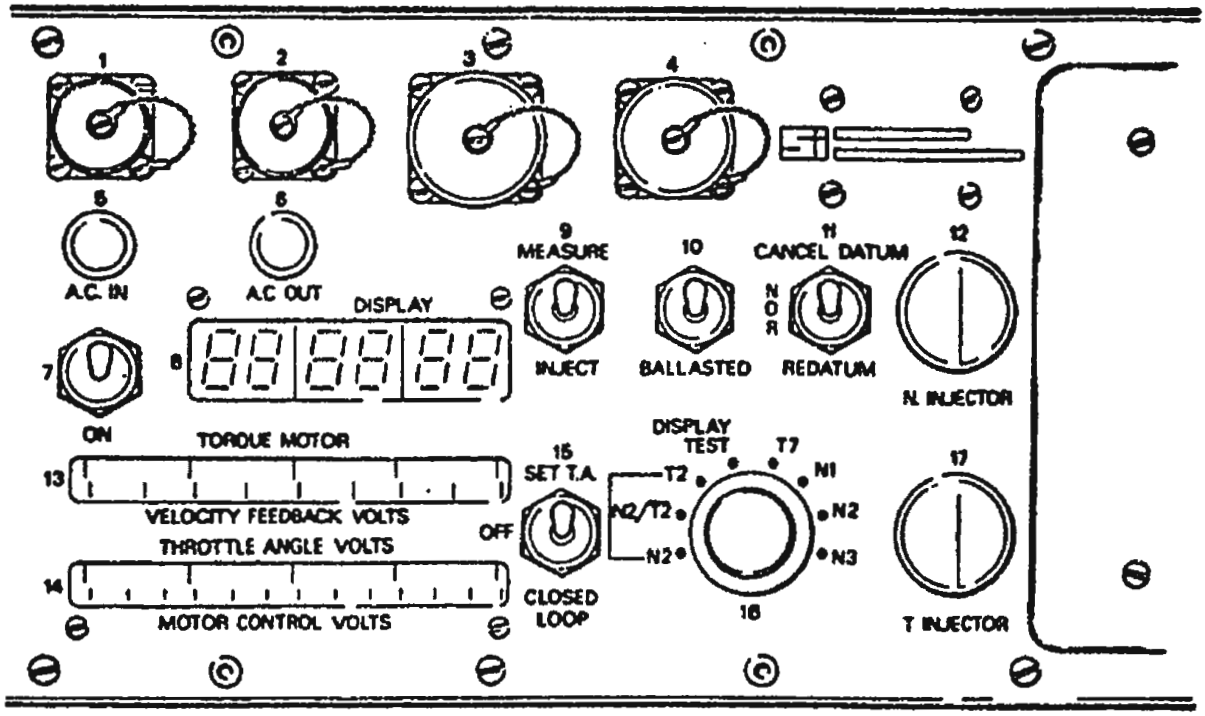


Thermocouple and Harness test
Figure 505



61503
M1-0000-77-315

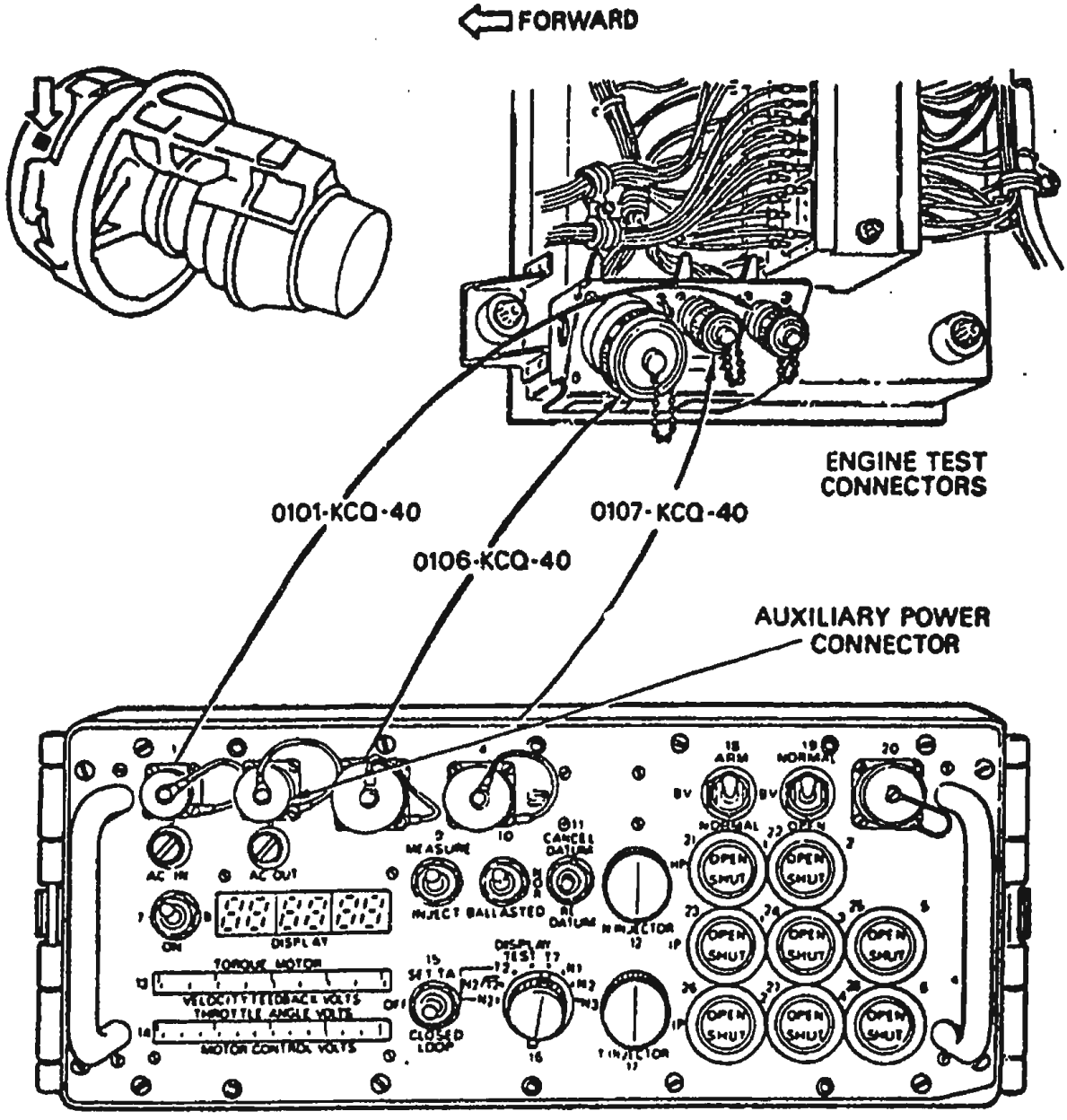
R Test Set (Smiths 4002-KTQ-1) Test Lead Connections
R Figure 506



58413
M1-0000-77-316

R Test Set (Smiths 4002-KTQ-1) Front Panel
R Figure 507

R EFFECTIVITY: ALL
R
001B



79096
M1-0000-77-317

R Test Set (Smiths 4001-KTQ-1) Front Panel
R and Test Lead Connections
R Figure 508

R EFFECTIVITY: ALL
R
001B

TURBINE GAS TEMPERATURE THERMOCOUPLE - REMOVAL AND INSTALLATION

1. Equipment and Materials

Splitter Area Access Work Platform, Rolls-Royce Ltd., PN CP 20309, or PN XUT.42526 Spacer and XUT.42527 Side Piece, or equivalent

Protective caps

2. Referenced Procedures

72-03-00 Gas Generator Fairings - Removal/Installation

78-30-00 Thrust Reverser - Servicing.

3. Removal/Installation

R The removal/installation of the 17 TGT thermocouples is identical except for thermocouple which has a bracket instead of washers installed under the securing bolts.

WARNING: DO NOT ENTER COLD STREAM NOZZLE UNTIL THRUST REVERSER IS LOCKED IN FORWARD THRUST POSITION.

A. Removal

(1) Lock thrust reverser system in forward-thrust position (Ref. 78-30-00).

(2) On pilots overhead circuit breaker panel CB1, zone 210, open and tag applicable circuit breaker ENGINE START CONT (E13, E14, or E15).

(3) Position splitter area access work platform in cold stream collector nozzle, zone 435.

(4) Remove following gas generator fairings (Ref. 72-03-00):

R (a) Engines No. 1 and 3

R Turbine section lower fairing 417A or 427A

R Turbine section LH side fairing 416BL or 426BL

R Turbine section RH side fairing 416BR or 426BR

Interservices fairing LH access panel 418CL, 428CL

Interservices fairing RH access panel 418CR or 428CR

Nozzle box flange LH, Center and RH access panels

(b) Engine No. 2

Turbine section lower fairing 437A

Turbine section LH fairing 436BL

Turbine section RH fairing 436BR

Interservices fairing LH access panel 438CL

Interservices fairing RH access panel 438CR

Nozzle box flange LH, center, and RH access panels.

(5) Release thermocouple harness from securing clips on both sides of thermocouple being removed then release securing nuts and move harness clear of thermocouple posts (Ref. Fig. 401).

(6) At position A (Ref. Fig. 401) leave bracket attached to cable support clip. Remove bolts and washers at all other positions.

(7) Remove thermocouple.

R R NOTE: At lower engine positions, sleeve assembly and spacer may come out with thermocouple removal.

(8) Install protective caps to exposed openings.

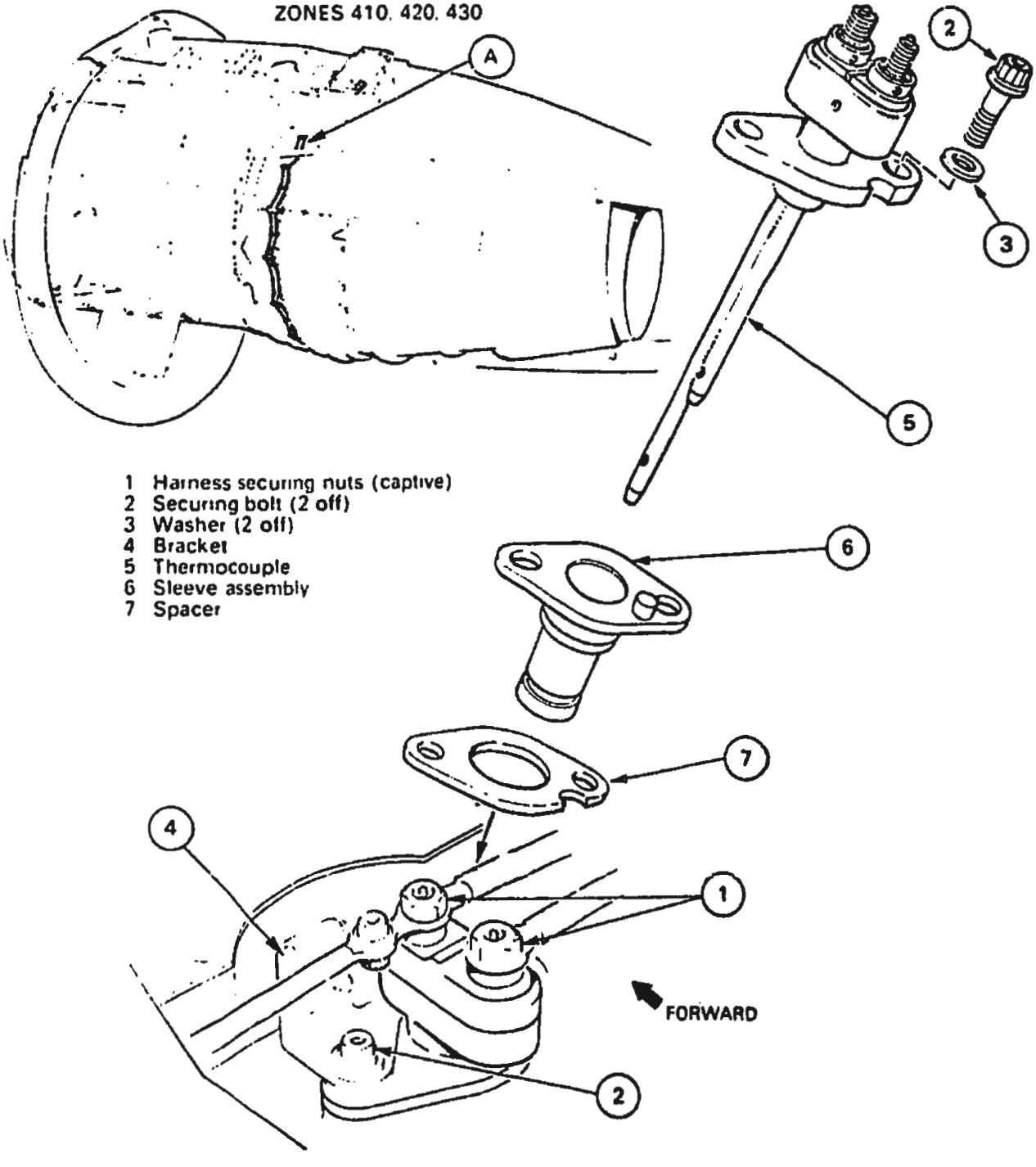
(9) Remove splitter area work platform from cold stream collector nozzle.

B. Installation

R (1) Verify that circuit breakers opened in Step 3A(2) are open and tagged.

(2) Verify that thrust reverser system is locked in forward-thrust position (Ref. 78-30-00).

(3) Verify that work platform installed in Step 3A(3) is in place.



R R Thermocouple - Removal and Installation
Figure 401

EFFECTIVITY: ALL

0018

(4) Remove protective caps from openings.

(5) Where applicable, install spacer and sleeve assembly with locating pin towards rear of engine (Ref. Fig. 401).

(6) Install thermocouple into sleeve assembly. Verify positive location on locating pin.

(7) Verify that thermocouple, sleeve, and spacer are correctly seated in IP turbine case then at position A, position bracket, install and secure bolts. At remaining positions install and secure washers and bolts.

(8) Place thermocouple harness on thermocouple and secure with harness securing nuts. Torque tighten nuts to 25 lb in.(2.82 Nm).

R

(9) Install gas generator fairings removed in Step 3A(4).

(10) Remove work platform from cold stream collector nozzle.

(11) Unlock thrust reverser system (Ref. 78-30-00).

(12) Remove tags and close circuit breakers opened in Step 3A(2).

(13) On next engine run, observe turbine gas temperature indications for required temperatures.

TURBINE GAS TEMPERATURE THERMOCOUPLE - ADJUSTMENT AND TEST

1. Equipment and Materials

Wheatstone bridge

R Insulation test meter (capable of testing insulation resistance at 4 to 20 volts DC)

Splitter Area Access Work Platform, Rolls-Royce Ltd., PN CP 20309, or PN XUT.42526 Spacer and XUT.42527 Side Piece, or equivalent

2. Referenced Procedures

72-03-00 Gas Generator Fairings - Removal/Installation

78-30-00 Thrust Reverser - Servicing.

3. Adjustment/Test

A. Thermocuple Resistance Test

WARNING: DO NOT ENTER COLD STREAM NOZZLE UNTIL THRUST REVERSER IS LOCKED IN FORWARD THRUST POSITION.

(1) Lock thrust reverser system in forward-thrust position (REf. 78-30-00).

(2) On pilots overhead circuit breaker panel CB1, zone 210, open and tag applicable circuit breaker ENGINE START CONT (E13, E14, or E15).

(3) Positon splitter area access work platform in cold stream collector nozzle, zone 435.

(4) Remove following gas generator fairings (Ref. 72-03-00):

(a) Turbine section lower fairing 417A, 427A, or 437A

(b) Turbine section LH side fairing 416BL, 426BL, or 436BL

(c) Turbine section RH side fairing 416BR, 426BR, or 436BR

(d) LH access panel 418CL, 428CL, or 438CL

(e) RH access panel 418CR, 428CR or 438CR

(f) Nozzle fox flange LH, center and RH panels

(5) Release thermocouple harness from securing clips on both sides of thermocouple being removed then release securing nuts and move harness clear of thermocouple posts (Ref. Fig. 501).

(6) Connect test leads of known resistance to terminal posts.

NOTE: Test leads must be connected directly to the thermocouple under test by nuts. Probes or crocodile clips are not satisfactory.

(7) Using wheatstone bridge, measure circuit resistance.
R After subtracting value of extension leads, the
R resistance value must be 8.1 to 8.8 ohms at 20 degrees
R C.

(8) For every degree centigrade that the thermocouple is above or below 20 degrees C the valve obtained shall be corrected by subtraction or addition of 0.05 percent.

(9) Disconnect wheatstone bridge and test leads.

(10) Using insulation test meter, measure resistance between each terminal post and ground. The resistance must not be less than 170,000 ohms in each case.

(11) Disconnect insulation test meter.

(12) Install harness on thermocouple terminal post and secure terminal nuts. Torque tighten nuts to 25 lb in.

(13) Repeat Steps (5) through (12) on remaining thermocouples as required.

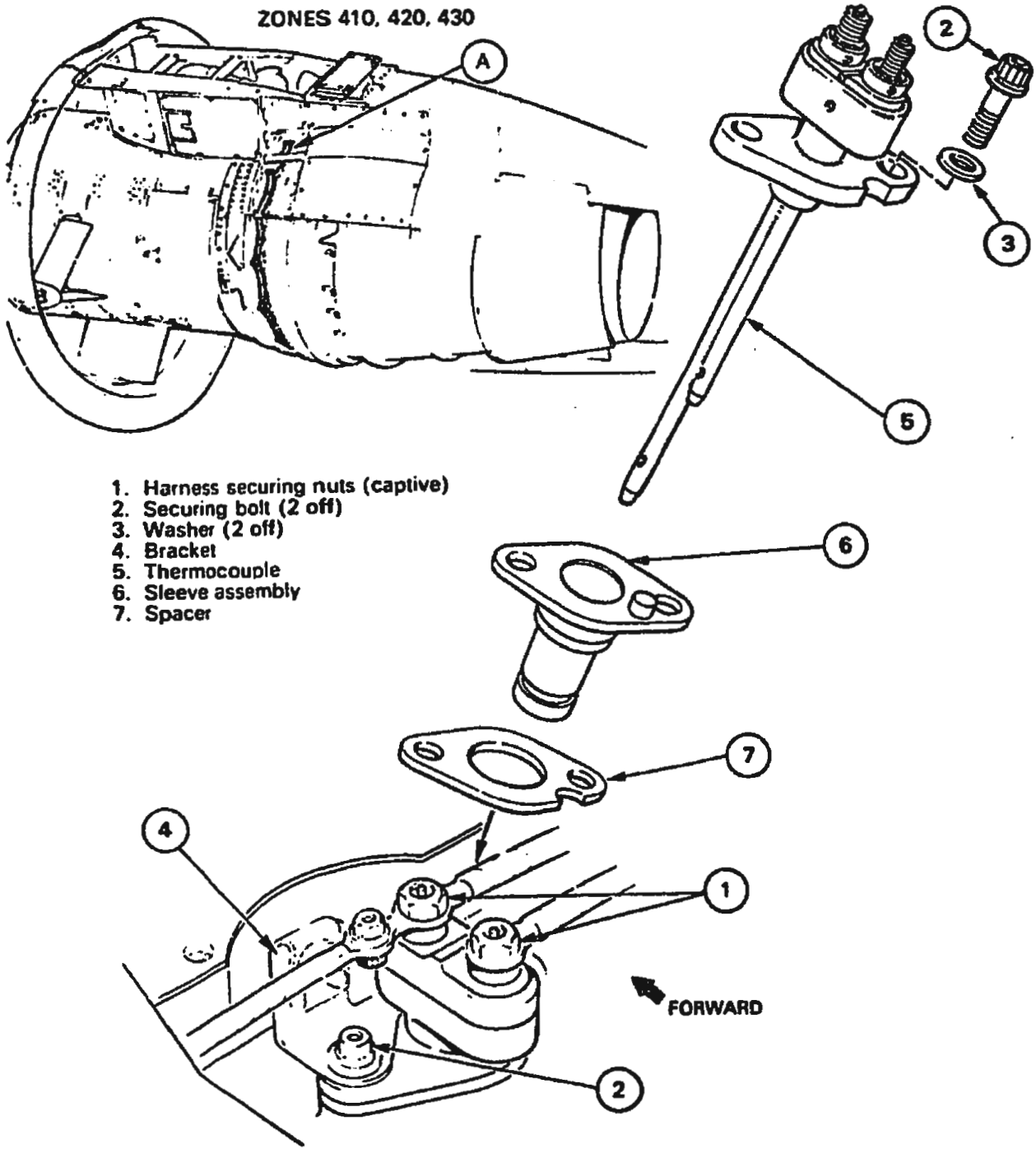
(14) Install gas generator fairings removed in Step (4).

(15) Remove work platform from cold stream collector nozzle.

(16) Unlock thrust reverser system (Ref. 78-30-00).

(17) Remove tags and close circuit breakers opened in Step (2).

(18) On next engine run observe turbine gas temperature indications for required temperatures.



1. Harness securing nuts (captive)
2. Securing bolt (2 off)
3. Washer (2 off)
4. Bracket
5. Thermocouple
6. Sleeve assembly
7. Spacer

M1–0102–77–426
26914A

Thermocouple – Adjustment and Test
Figure 501

TURBINE GAS TEMPERATURE INDICATOR - REMOVAL AND INSTALLATION

1. Removal/Installation

   A. Removal

      (1) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag circuit breaker TGT WARN (R11).

      On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breaker IND LT PILOTS (J2).

      On pilots overhead circuit breaker panel CB1, zone 210, open and tag applicable circuit breaker ENGINE TGT (F10, F11, or F12).

      (2) Locate the turbine gas temperature (TGT) indicator, between the N1 and N3 compressor shaft speed indicators, and loosen captive triwing fasteners (Ref. Fig. 401).

      (3) Withdraw indicator from panel far enough to permit separation of electrical harness connector from indicator connector.

      (4) Tape and stow electrical connector.

   B. Installation

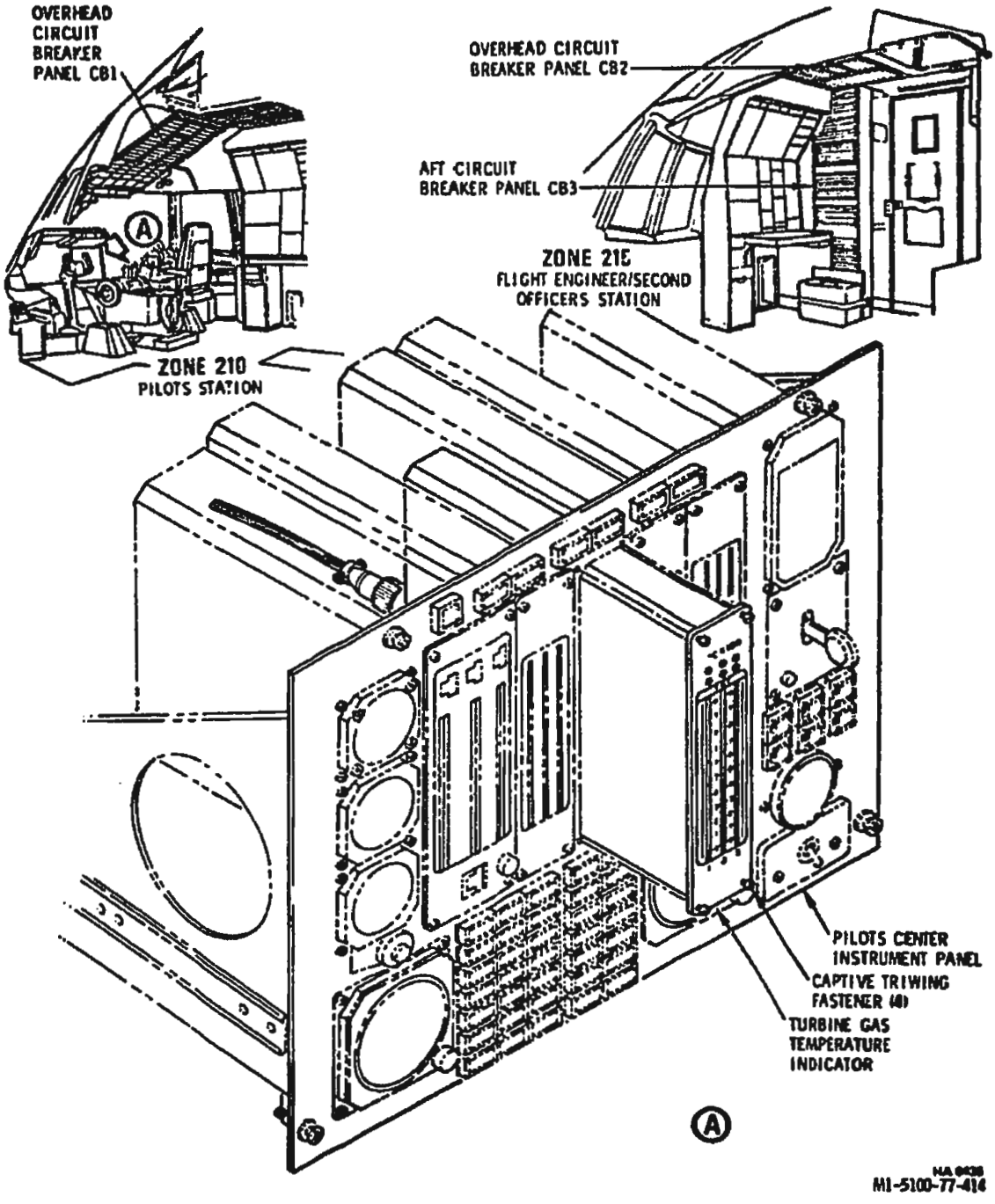
      (1) Verify that circuit breakers opened in Step A(1) are open and tagged.

      (2) Mate cable-mounted electrical connector to connector on rear of indicator.

      (3) Slide indicator into panel cutout until flange contacts panel. Secure indicator by tightening captive triwing fasteners.

      (4) Remove tags and close circuit breakers opened in Step A(1).

      (5) During the next engine motoring or runup procedure, verify that indicator performs satisfactorily.



Turbine Gas Temperature Indicator - Removal and Installation
Figure 401

TURBINE GAS TEMPERATURE (TGT) ELECTRICAL CABLE AND TERMINAL BLOCK REMOVAL AND INSTALLATION

1. General

This procedure provides instructions for removal and installation of the TGT ballast resistor, trim resistor and lead terminals from the terminal block.

2. Equipment and Materials

Splitter area access work platform, Rolls-Royce Ltd., PN CP20309, or PN XUT.42526 Spacer and XUT.42527 Side Piece, or equivalent

3. Referenced Procedures

72-03-00	Gas Generator Fairings - Maintenance Practices
77-21-04	Turbine Gas Temperature (TGT) Electrical and Terminal Block - Adjustment and Test
78-30-00	Thrust Reverser - Maintenance Practices

4. Removal/Installation (Resistors and Lead Terminals)

WARNING: DO NOT ENTER COLD STREAM NOZZLE UNTIL THRUST REVERSER IS LOCKED IN FORWARD-THRUST POSITION.

A. Removal

(1) Lock thrust reverser system in forward-thrust position (Ref. 78-30-00).

(2) On pilots overhead circuit breaker panel CB1, zone 210, open and tag applicable circuit breaker ENGINE START CONT (E13, E14, or E15).

(3) Position splitter area access work platform in cold stream collector nozzle, zone 435.

(4) Remove interservices fairing RH front access panel (Ref. 72-03-00).

R (5) On engines with RR SB72-5615,
R remove nuts and washers securing heat shield and remove
R heat shield and spacers.

R (6) Remove nuts that secure resistors and terminal leads to terminal posts (Ref. Fig. 401).

R (7) Remove terminal leads, ballast resistor and trim resistor from terminal posts.

R (8) Install tags on terminal leads for identification during installation.

B. Installation

(1) Verify that thrust reverser system is locked in forward-thrust position (Ref. 78-30-00).

(2) Verify that circuit breakers opened in Step 4A(2) are open and tagged.

(3) Verify that work platform is in place.

(4) Remove tags from terminal leads observing identity of leads.

(5) Install terminal leads, ballast resistor and trim resistor on terminal posts (Ref. Fig. 401).

C NOTE: For proper resistor code, see engine data plate
C on right side of fan case (See Fig. 402).

(6) Install and secure terminal post nuts.

R (7) On engines with RR SB72-5615,
R install spacers and heat shield and secure with nuts
R and washers.

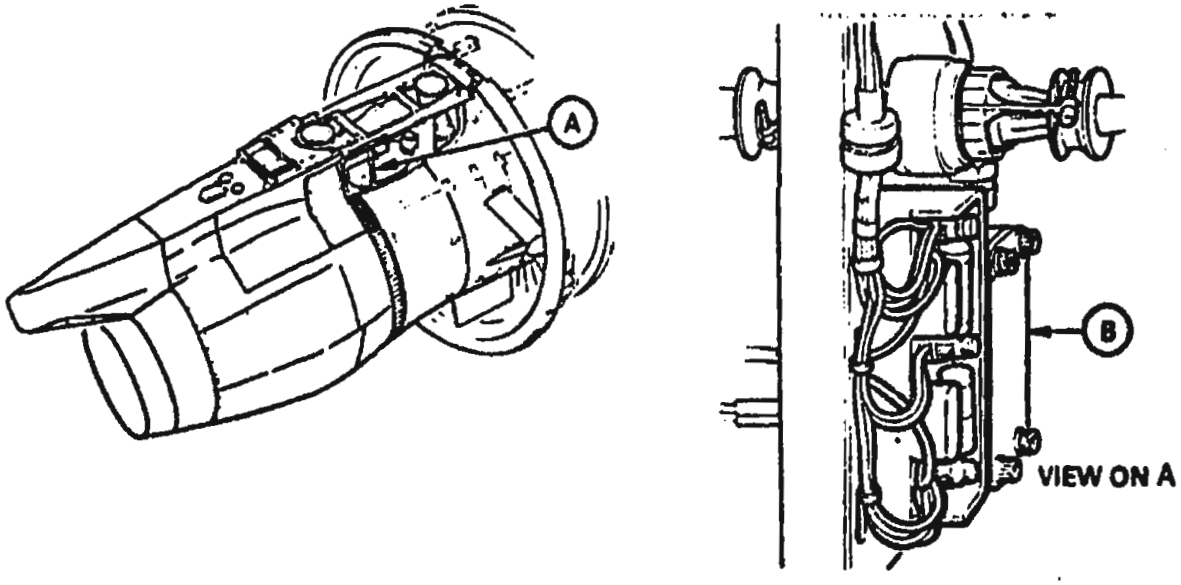
R (8) Install interservices RH front fairing (Ref. 72-03-00).

R (9) Remove work platform from cold stream collector nozzle.

R (10) Close circuit breakers opened in Step 4A(2).

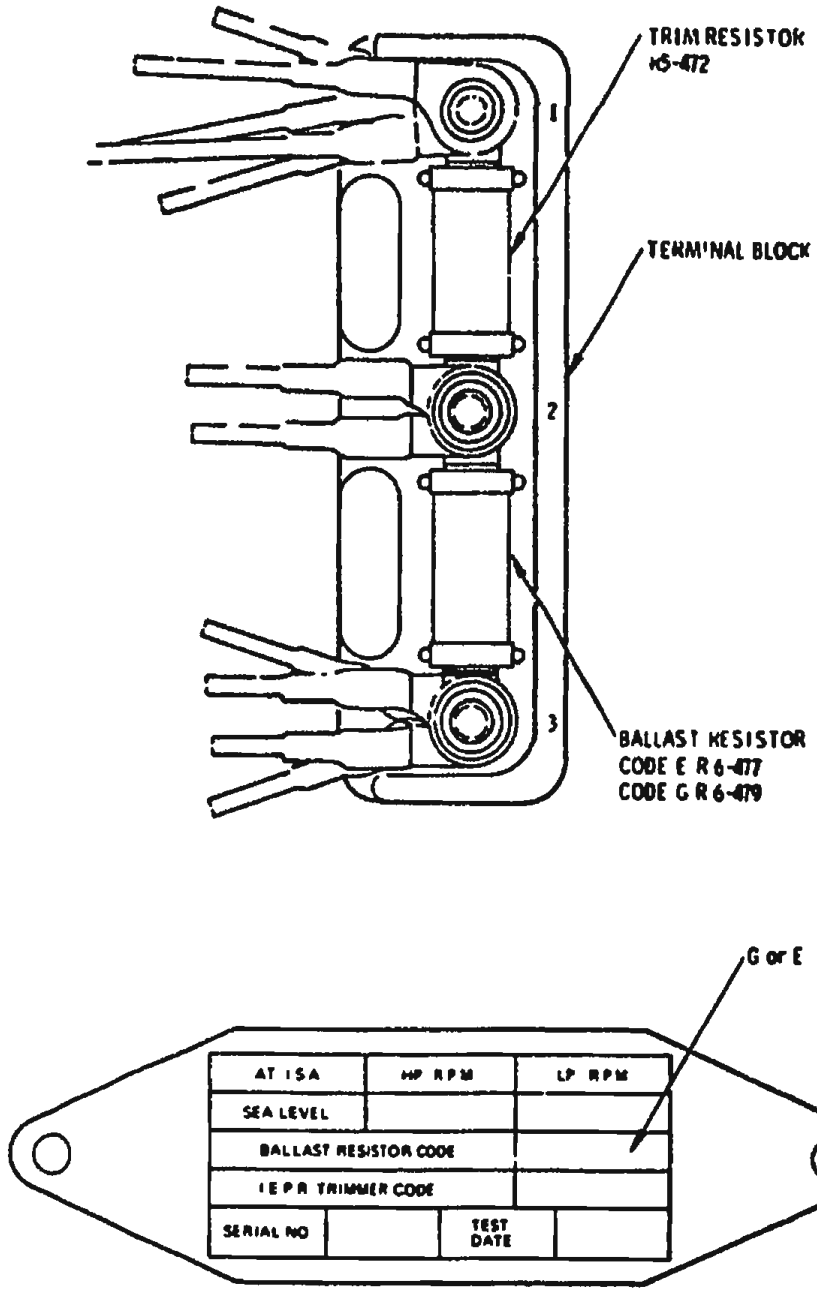
R (11) Unlock thrust reverser system (Ref. 78-30-00).

R (12) On next engine run, observe turbine gas temperature indications for required temperatures, or perform ballast and trim resistor test (Ref. 77-21-04, Adjustment and Test).



R Terminal Block Leads and Resistors
R Figure 401

R EFFECTIVITY: ALL
R
001B



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CR
CR

TGT Ballast Resistor Code
Figure 402

R EFFECTIVITY: ALL
R
001B

TURBINE GAS TEMPERATURE (TGT) ELECTRICAL CABLE AND TERMINAL BLOCK ADJUSTMENT AND TEST

1. General

This procedure provides instructions to test resistance of ballast and trim resistors.

2. Equipment and Materials

Wheatstone bridge

Test leads

3. Referenced Procedure

77-21-04 Turbine Gas Temperature (TGT) Electrical Cable and Terminal Block - Removal and Installation

4. Adjustment/Test

NOTE: Test leads must be connected directly to the resistor under test with nuts and bolts. Probes or crocodile clips are not satisfactory.

A. Ballast Resistor and Trim Resistor Resistance Test

(1) Remove ballast resistor and trim resistor from terminal block (Ref. 77-21-04).

(2) Connect test leads, of known resistance value, to ballast resistor terminals.

NOTE: The ballast resistor terminal holes are the same diameter.

(3) Connect Wheatstone bridge to test leads.

CAUTION: ALLOW RESISTOR TO ATTAIN AMBIENT TEMPERATURE BEFORE MEASURING VALUE.

(4) Measure resistance of ballast resistor. After subtracting resistance value of test leads, the ballast resistor value must be within ±1 ohm of applicable value shown in Table 501.

R

Ballast Resistor Values
Table 501

	AMBIENT TEMPERATURE DEGREES C	-40	-20	0	+20	+40
R	Ballast Resistor Code H (Engines without SB77-3399)	61.7	63.8	65.9	68.0	70.1
R	Ballast Resistor Code G (Engines with SB77-3399)	66.4	68.6	70.9	73.1	75.4
R	Ballast Resistor Code E (Engines with SB77-3822)	76.0	78.6	81.2	83.8	86.3
R	Ballast Resistor Code C (Engines with SB77-5708)	85.6	88.6	91.5	94.4	97.3

(5) Disconnect test leads from ballast resistor and connect test leads to trim resistor terminals.

NOTE: The trim resistor terminal holes have different diameters.

(6) Measure resistance of trim resistor. After subtracting resistance value of test leads, resistance value must be 1000 (±10) ohms.

(7) Install ballast resistor and trim resistor to terminal block (Ref. 77-21-04).

TURBINE GAS TEMPERATURE (TGT) ELECTRICAL CABLE AND TERMINAL BLOCK INSPECTION AND CHECK

1. Referenced Procedures

71-21-04	Turbine Gas Temperature (TGT) Electrical Cable and Terminal Block - Removal and Installation
71-21-04	Turbine Gas Temperature (TGT) Electrical Cable and Terminal Block - Adjustment and Test

2. Inspection/Check

A. Inspect Thermocouple Terminal Block

(1) Remove resistors and terminal leads (Ref. 71-21-04, Removal/Installation).

(2) Inspect thermocouple terminal block ceramic for cracks (Ref. Para 2B).

(3) Install resistors and terminal leads (Ref. 71-21-04, Removal/Installation).

B. Acceptance Standards

(1) Open cracks in the ceramic are not acceptable.

(2) Hairline cracks are acceptable provided the circuit and insulation resistance values are within limits (Ref. 71-21-04, Adjustment/Test) and, with a test torque of 38 to 42 lb in. applied to the terminal post nuts, the crack does not open and the terminal post does not move.

THERMOCOUPLE HARNESS - REMOVAL AND INSTALLATION

1. Equipment and Materials

Splitter Area Access Work Platform, Rolls Royce Ltd., PN CP20309, or PN XUT.42526 Spacer and XUT.42527 Side Piece, or equivalent

PTFE Adhesive Tape, or equivalent

2. Referenced Procedures

72-03-00 . Gas Generator Fairings - Maintenance Practices

78-30-00 . Thrust Reverser - Maintenance Practices

3. Removal/Installation

WARNING: DO NOT ENTER COLD STREAM NOZZLE UNTIL THRUST REVERSER IS LOCKED IN FORWARD THRUST POSITION.

A. Removal

(1) Lock thrust reverser system in forward-thrust position (Ref. 78-30-00).

(2) On pilots overhead circuit breaker panel CB1, zone 210, open and tag applicable circuit breaker ENGINE START CONT (E13, E14, or E15).

(3) Position splitter area access work platform in cold stream collector nozzle, zone 435.

(4) Remove following gas generator fairings (Ref. 72-03-00).

(a) Turbine section lower fairing

(b) Turbine section LH and RH side fairings

(c) LH and RH access panels

(d) Nozzle box flange LH, Center, and RH access panels.

(5) Remove attaching hardware securing extension leads (Ref. Fig. 401).

(6) Release captive nuts securing harness to thermcouples.

R (7) On engines without RR SB78-3551, progressively remove securing clip assemblies starting with top securing clip assembly and spacer (Ref. Fig. 401); remove harness.

R (7) On engines with RR SB78-3551, progressively remove securing clips 4 through 9 (Ref. Fig. 401); remove harness.

B. Installation

(1) Verify that thrust reverser system is locked in forward-thrust position (Ref. 78-30-00).

(2) Verify that circuit breakers opened in Step 3A(2) are open and tagged.

(3) Verify that work platform is in place.

(4) Attach harness on thermocouple as follows (Ref. Fig. 401):

(a) Position end terminal of white harness (Pos.) on rear stud of thermocouple (A Fig. 401) with terminal lug in direction shown.

(b) Position end terminal of green harness (Neg.) on front stud of the thermocouple (B Fig. 401) with terminal lug in direction shown.

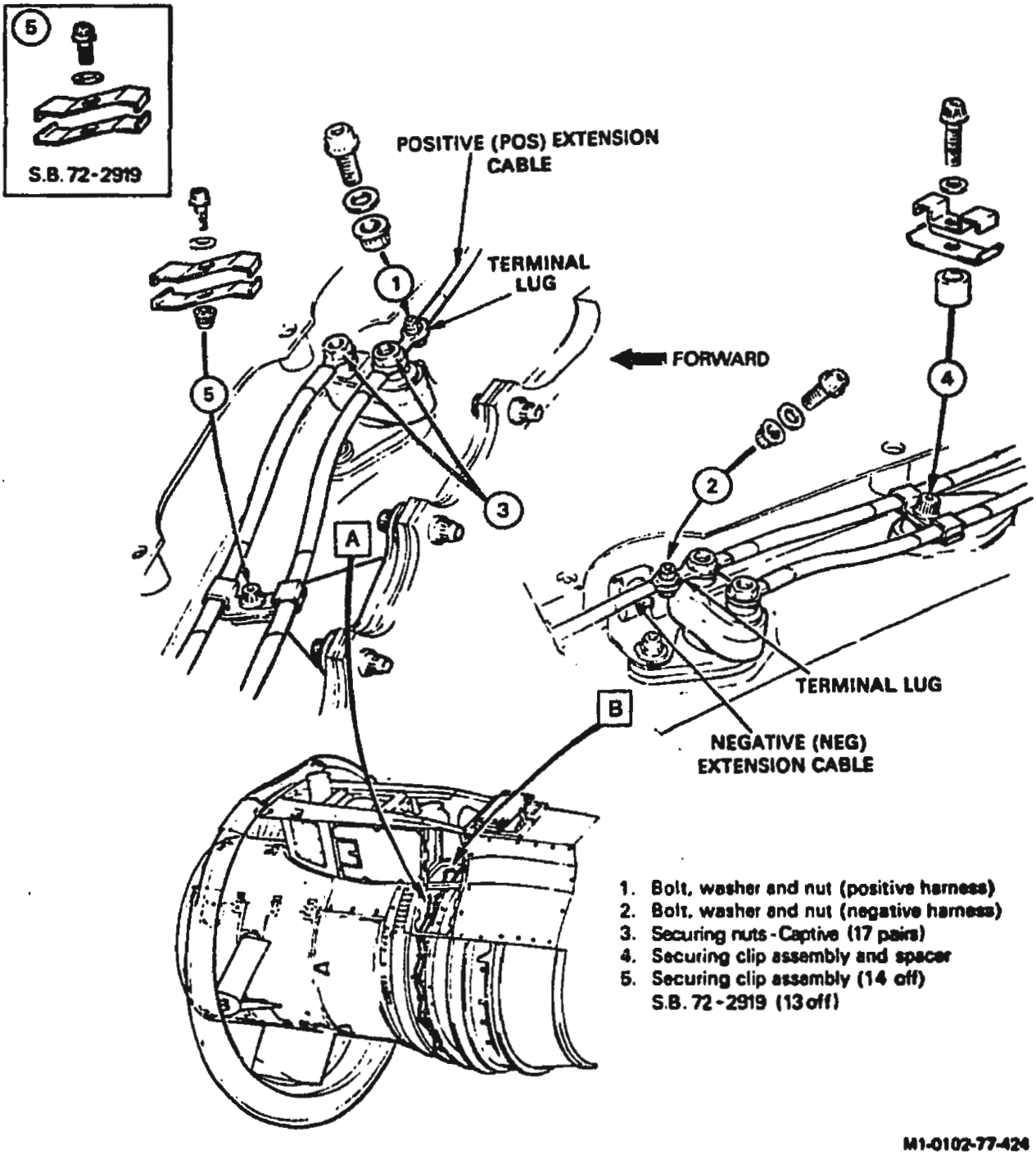
(5) Progressively position harness to thermocouples and secure nuts. Torque tighten nuts to 25 lb in.

R (6) On engines with RR SB72-2919,
R bind harness with PTFE tape for a distance of 2 inches (50/8mm) where harness passes through clip assembly (Ref. Fig. 401, Sheet 2, Item 9).

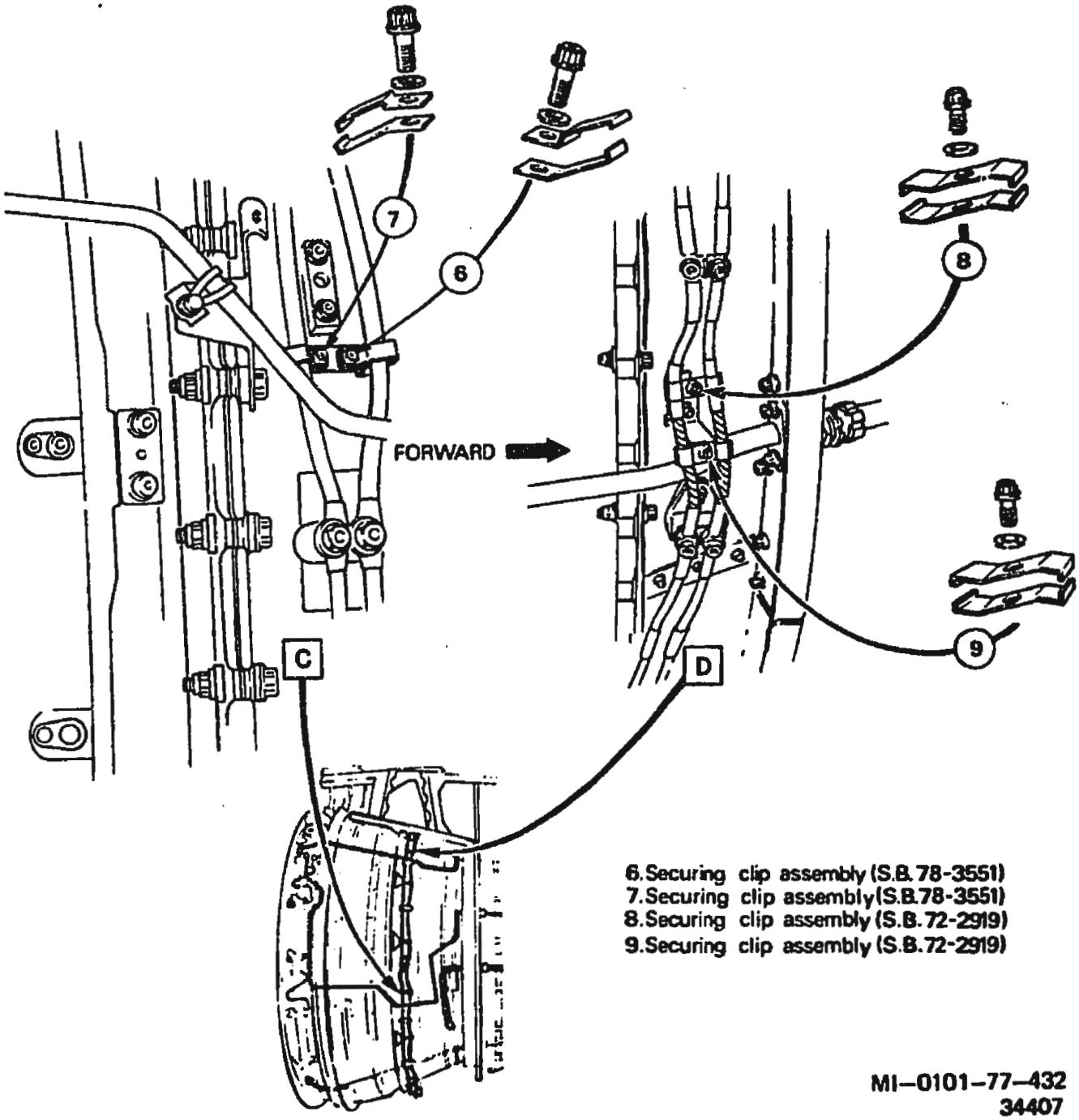
R (7) On engines without RR SB78-3551, progressively install and secure clips removed in Step 3A(7) (Ref. Fig. 401).

R (7) On engines with RR SB78-3551, progressively install and secure clips 4 through 9 (Ref. Fig. 401).

(8) Install and secure bolts, washers, and nuts attaching green extension lead to green harness terminal lug and white extension lead to white harness terminal lug.



Thermocouple Harness - Removal and Installation
Figure 401 (Sheet 1)



6. Securing clip assembly (S.B. 78-3551)
7. Securing clip assembly (S.B. 78-3551)
8. Securing clip assembly (S.B. 72-2919)
9. Securing clip assembly (S.B. 72-2919)

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34407

Thermocouple Harness - Removal and Installation
Figure 401 (Sheet 2)

NOTE: Attach the green extension cable to the underside of the green harness terminal lug and the white extension cable to the underside of the white harness terminal lug.

R (9) Install gas generator fairings removed in Step 3A(4) then remove work platform from cold stream collector nozzle.

(10) Unlock thrust reverser system (Ref. 78-30-00).

(11) Remove tags and close circuit breakers opened in Step 3A(2).

(12) On next engine run observe turbine gas temperature indications for required temperature.

THERMOCOUPLE HARNESS - ADJUSTMENT AND TEST

1. Equipment and Materials

Wheatstone bridge

2. Referenced Procedure

77-21-05 Thermocouple Harness - Removal and Installation

3. Adjustment/Test

A. Harness Circuit Resistance Test

NOTE: Test leads must be connected directly to the cables under test by nuts and bolts. Probes or crocodile clips are not satisfactory.

(1) Remove thermocouple harness (Ref. 77-21-05, Removal and Installation).

(2) Connect test leads, of known resistance value, to each end of nickel/chromium harness (white).

(3) Using wheatstone bridge measure circuit resistance. After subtracting value of extension leads, resistance must be 0.37 to 0.53 ohm.

(4) Disconnect test leads from nickel/chromium harness.

(5) Connect test leads to each end of nickel/aluminum harness (green).

(6) Using wheatstone bridge measure circuit resistance. After subtracting value of extension leads, resistance must be 0.14 to 0.22 ohm.

(7) Disconnect test leads from nickel/aluminum harness.

(8) Install harness (Ref. 77-21-05, Removal and Installation).

THERMOCOUPLE HARNESS - APPROVED REPAIRS

1. Equipment and Materials

   Kapton film Electrical Tape, British Spec Permacel EE-5379, or equivalent

2. Approved Repair

   A. Harness Protection PTFE Sleeve Repair

      NOTE: The following repair must only be effected if the harness insulation is undamaged.

R   (1) Wrap the damaged sleeve with Kapton tape ensuring the crack is fully covered.

ENGINE COOLING AIR OVERHEAT INDICATING SYSTEM DESCRIPTION AND OPERATION

1. General

The engine cooling air overheat indicating system provides remote visual indication if temperatures in the engine internal cooling and sealing airflow system (Ref. 72-02-00) exceed a predetermined maximum.

The system comprises air sampling tubes connected to differential expansion switches, located in zones 412, 422 and 432, which are electrically connected through the engine electrical harness (Ref. 71-50-00), control relays and aircraft wiring to warning lights at the flight station.

Two internal sampling tubes convey air from the front and rear of the IP turbine rotor to external tubes which then pass the air to a mixing block mounted on the left-hand side of the IP turbine outer case. The temperature of the combined cooling air flow is then sensed by two identical expansion switches mounted on the mixing block.

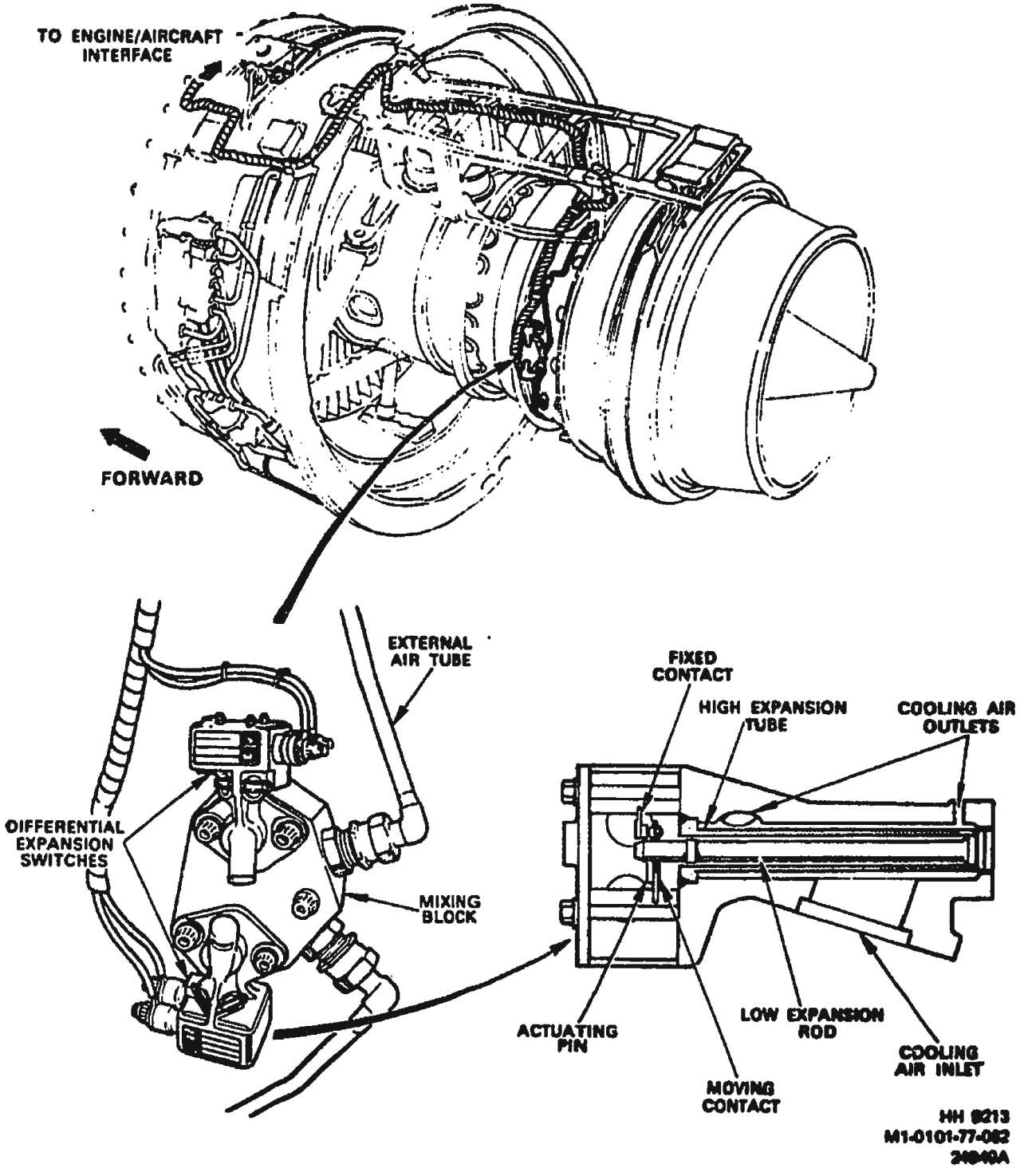
The switches are electrically connected to their control relays through two separate parallel channels. The control relays, which are normally energized open, are electrically connected in series in the warning light circuit, thus both relays must be deenergized before an indication is given at the flight station. This reduces the possibility of false warnings.

A press-to-test capability at the Flight Engineer/Second Officers ENGINE TURB COOLING AIR panel, zone 215, simulates operation of the expansion switches to verify satisfactory functioning of the remainder of the system.

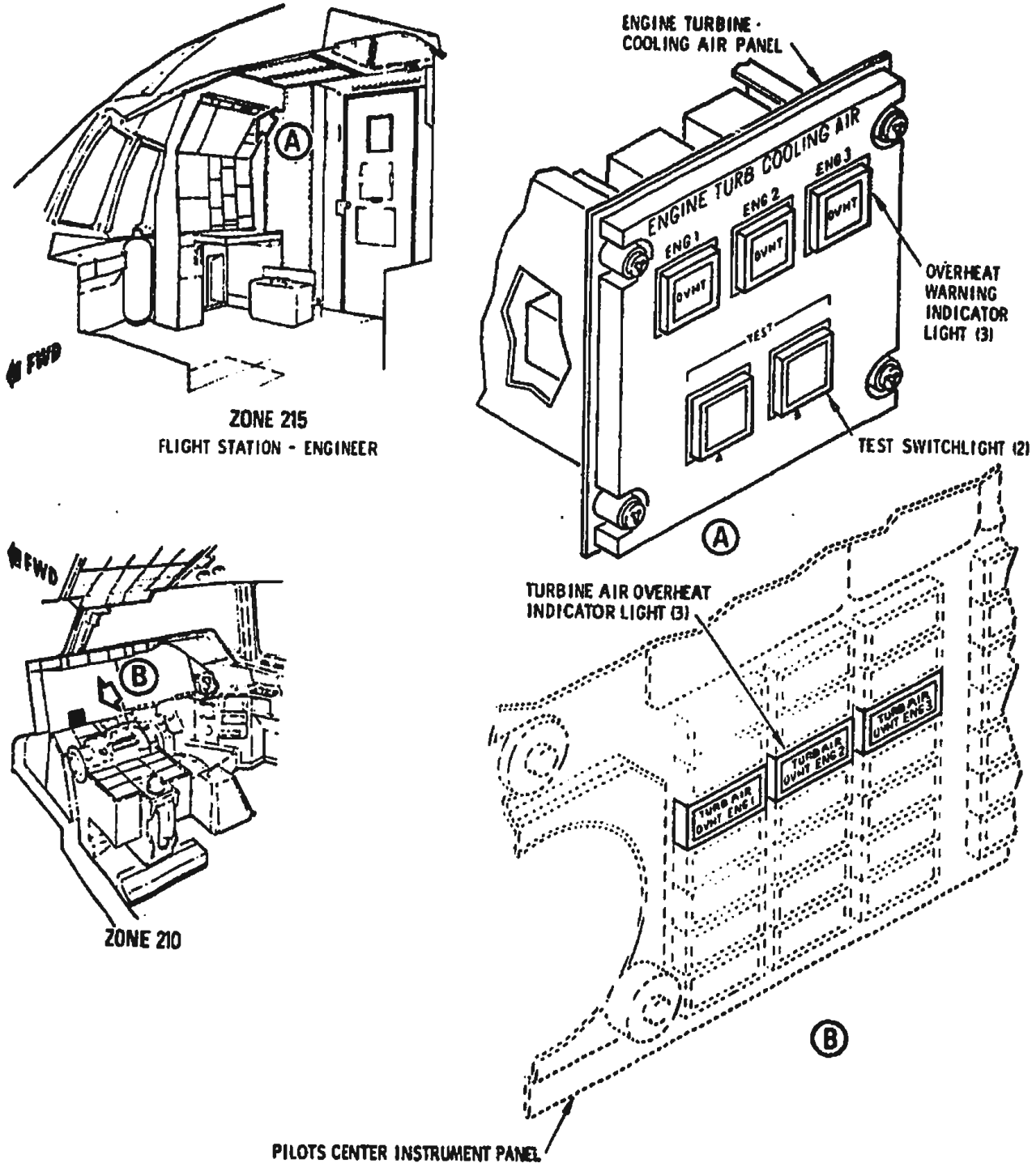
Three red OVHT warning indicator lights are located on the FE/SO ENGINE TURB COOLING AIR panel, zone 215. Two white TEST switchlights, identified for systems A and B, are mounted below
R the indicator lights.

R Three TURB AIR OVHT indicator lights are located on the pilots
R center instrument panel, zone 210. If the temperature increases
R to the alarm value in the cooling and sealing air, the
R applicable lights on the pilots center instrument panel and on
R the FE/SO ENGINE TURB COOLING AIR panel will come ON for a
R warning indication.

The Flight Engineer/Second Officer can test operation of the warning lights at any time on circuits A or B by depressing the TEST pushbutton switchlights.



Cooling Air Overheat Indicating System Engine Units
Figure 1 (Sheet 1)



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R Cooling Air Overheat Indicating System Aircraft Units
R Figure 1 (Sheet 2)

2. Differential Expansion Switch

A. Description and Operation

Each switch (Ref. Fig. 1), located in zones 412, 422 and 432, basically comprises a housing containing sensor and contact assemblies.

The housing accommodates a two-bolt mounting flange, two terminal posts, and an inlet and three outlets for the sampled internal cooling air (Ref. 72-02-00). The air, after flowing through the housing, exhausts into Zone 4a of the accessory cooling system (Ref. 75-21-00).

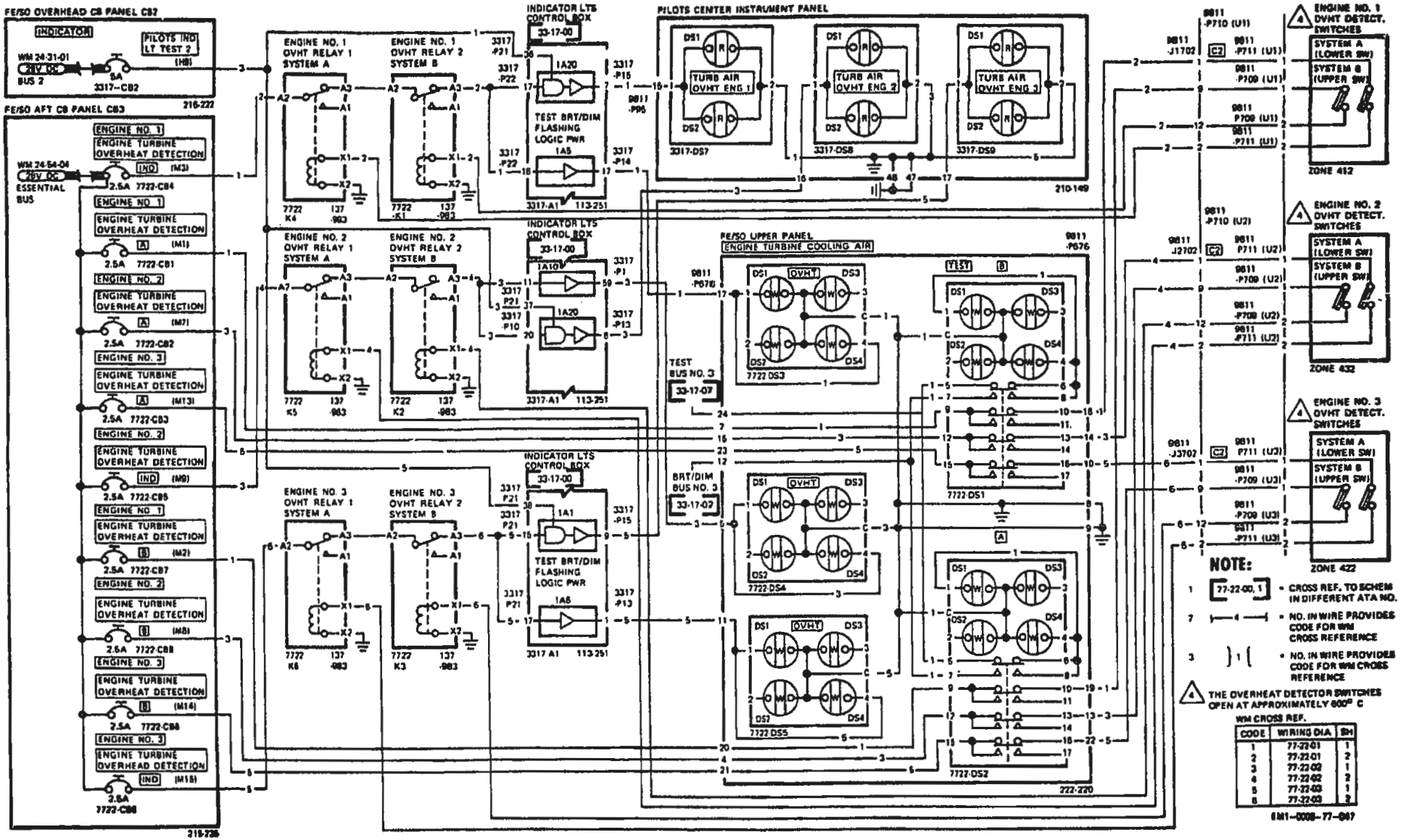
The sensor assembly comprises a rod of low expansion material positioned inside a tube of high expansion material. One end of the tube is welded to the switch housing and the other end to one end of the rod. The free end of the rod accommodates a contact actuating pin.

The contact assembly comprises fixed and moving contacts which are normally closed. The moving contact is located in front of the actuating pin and any rod movement is transferred through the pin to the moving contact.

During normal engine operation the contacts of the switches remain closed. This completes a holding circuit, keeping the control relays energized open and causing the warning lights to remain off.

If a temperature increase occurs in the cooling and sealing air, it is sensed by the expansion tubes in the switches, causing the tubes to extend. Should the air temperature increase to the alarm value, the growth in the expansion tubes is sufficient to cause the rods, through the actuating pins, to open the contacts.

The action of the contacts opening breaks the holding circuit to the control relays allowing them to close, thus causing the warning lights at the flight station to come on, indicating an overheat condition.


FE/SO OVERHEAD CB PANEL CB2
INDICATOR
PILOTS IND LT TEST 2
WM 24-31-01
28V DC BUS 2
5A
3317-CB2
FE/SO AFT CB PANEL CB3
WM 24-54-04
28V DC ESSENTIAL BUS
ENGINE NO. 1 ENGINE TURBINE OVERHEAT DETECTION
ENGINE NO. 2 ENGINE TURBINE OVERHEAT DETECTION
ENGINE NO. 3 ENGINE TURBINE OVERHEAT DETECTION
ENGINE NO. 1 OVHT RELAY 1 SYSTEM A
ENGINE NO. 1 OVHT RELAY 2 SYSTEM B
ENGINE NO. 2 OVHT RELAY 1 SYSTEM A
ENGINE NO. 2 OVHT RELAY 2 SYSTEM B
ENGINE NO. 3 OVHT RELAY 1 SYSTEM A
ENGINE NO. 3 OVHT RELAY 2 SYSTEM B
INDICATOR LTS CONTROL BOX 33-17-00
TEST BRT/DIM FLASHING LOGIC PWR
PILOTS CENTER INSTRUMENT PANEL
TURB AIR OVHT ENG 1
TURB AIR OVHT ENG 2
FE/SO UPPER PANEL ENGINE TURBINE COOLING AIR
TEST BUS NO. 3 33-17-07
BRT/DIM BUS NO. 3 33-17-02
ENGINE NO. 1 OVHT DETECT. SWITCHES
ENGINE NO. 2 OVHT DETECT. SWITCHES
ENGINE NO. 3 OVHT DETECT. SWITCHES
SYSTEM A (LOWER SW)
SYSTEM B (UPPER SW)
ZONE 412
ZONE 432
ZONE 422
NOTE:
CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
NO. IN WIRE PROVIDES CODE FOR WM CROSS REFERENCE
NO. IN WIRE PROVIDES CODE FOR WM CROSS REFERENCE
THE OVERHEAT DETECTOR SWITCHES OPEN AT APPROXIMATELY 600° C
WM CROSS REF.
CODE
WIRING DIA
SH
1 77-22-01 1
2 77-22-01 2
3 77-22-02 1
4 77-22-02 2
5 77-22-03 1
6 77-22-03 2
8M1-0008-77-067

Engine Cooling Air Overheat Schematic
Figure 2

R ENGINE COOLING AIR OVERHEAT INDICATING SYSTEM - FAULT ISOLATION

R 1. General

R The fault isolation diagrams in this section can be used for fault isolation any time a fault is reported or suspected. Before fault isolation is started, the PREREQUISITES listed on the diagram must be fulfilled.

R If the flight crew reports a trouble using a FIRM Fault Code number, the number can be found in the FIRM Fault Code Cross Reference Table in the Chapter 77-INDEX.

R The FIRM Fault Code Cross Reference Table includes the flight report (fault symptoms) and the exact Section, Figure, Sheet, and Block number where fault isolation should begin. (Refer to the L-1011 Maintenance Manual Introduction for a more detailed explanation on the use of fault isolation diagrams.)

R If a fault is reported or suspected and no FIRM Fault Code is available, the function or fault indication can be found in the table below. When a diagram is selected in this manner fault isolation is started at Block 1.

R 2. Fault Isolation/Identification

R Table 101 is a list of all fault isolation data in this section of the manual.

R Engine Cooling Air Overheat System Fault Isolation
R Table 101

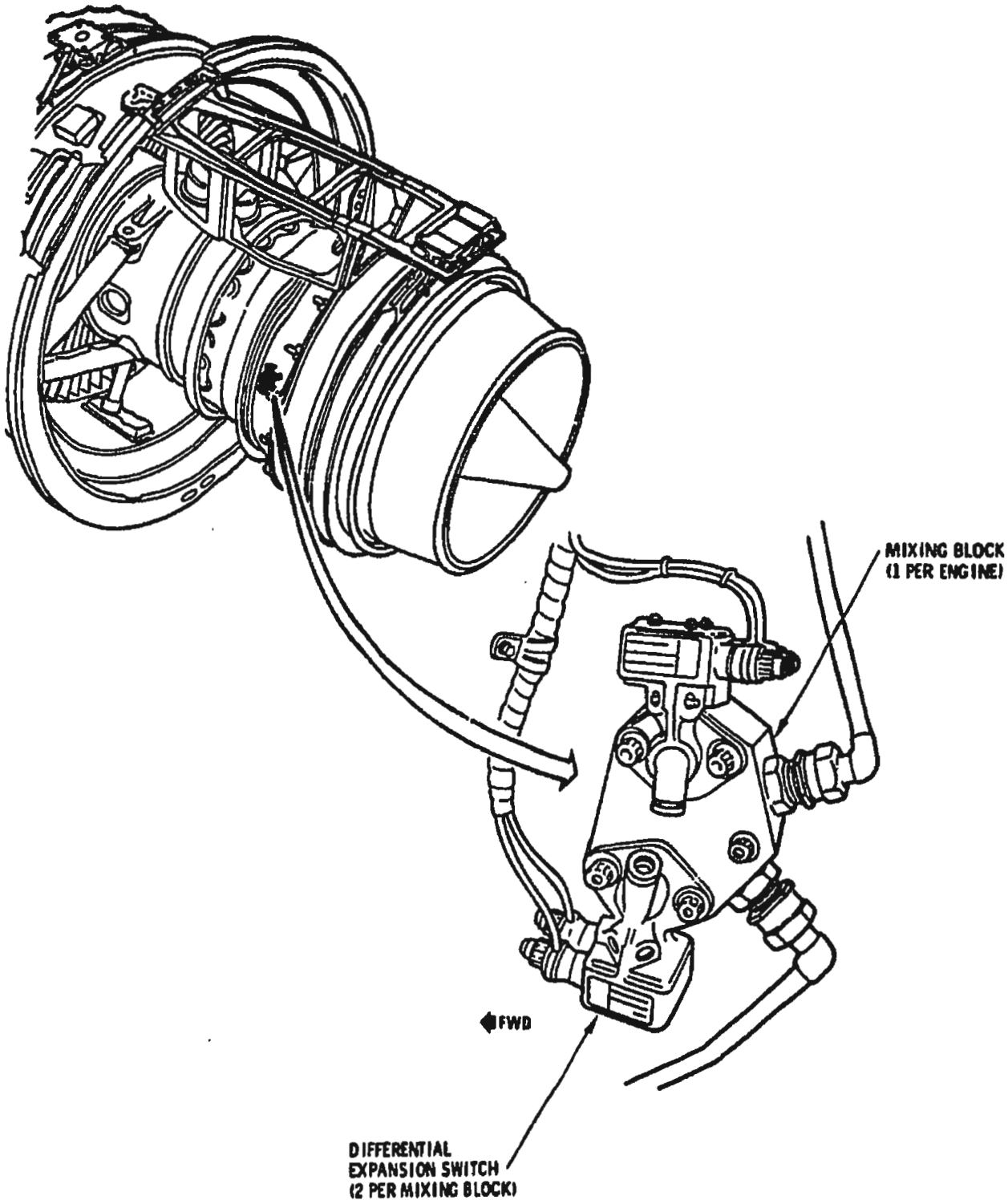
FIGURE	TITLE
101	Component Location Index
102	Component Locator
103	Engine Cooling Air Overheat Fault Isolation
SCHEM 1	Engine Cooling Air Overheat Indicating Circuits

COMPONENT	QTY	AREA/ACCESS	REFERENCE
DIFFERENTIAL EXPANSION SWITCH	6	ENGINE TURB. SECTION/TURBINE SECTION LOWER FAIRING AND TURBINE SECTION LH SIDE FAIRING	77-22-01

M1-0000-77-195

Component Location Index
Figure 101

R
R
R EFFECTIVITY: ALL
R
R
001B



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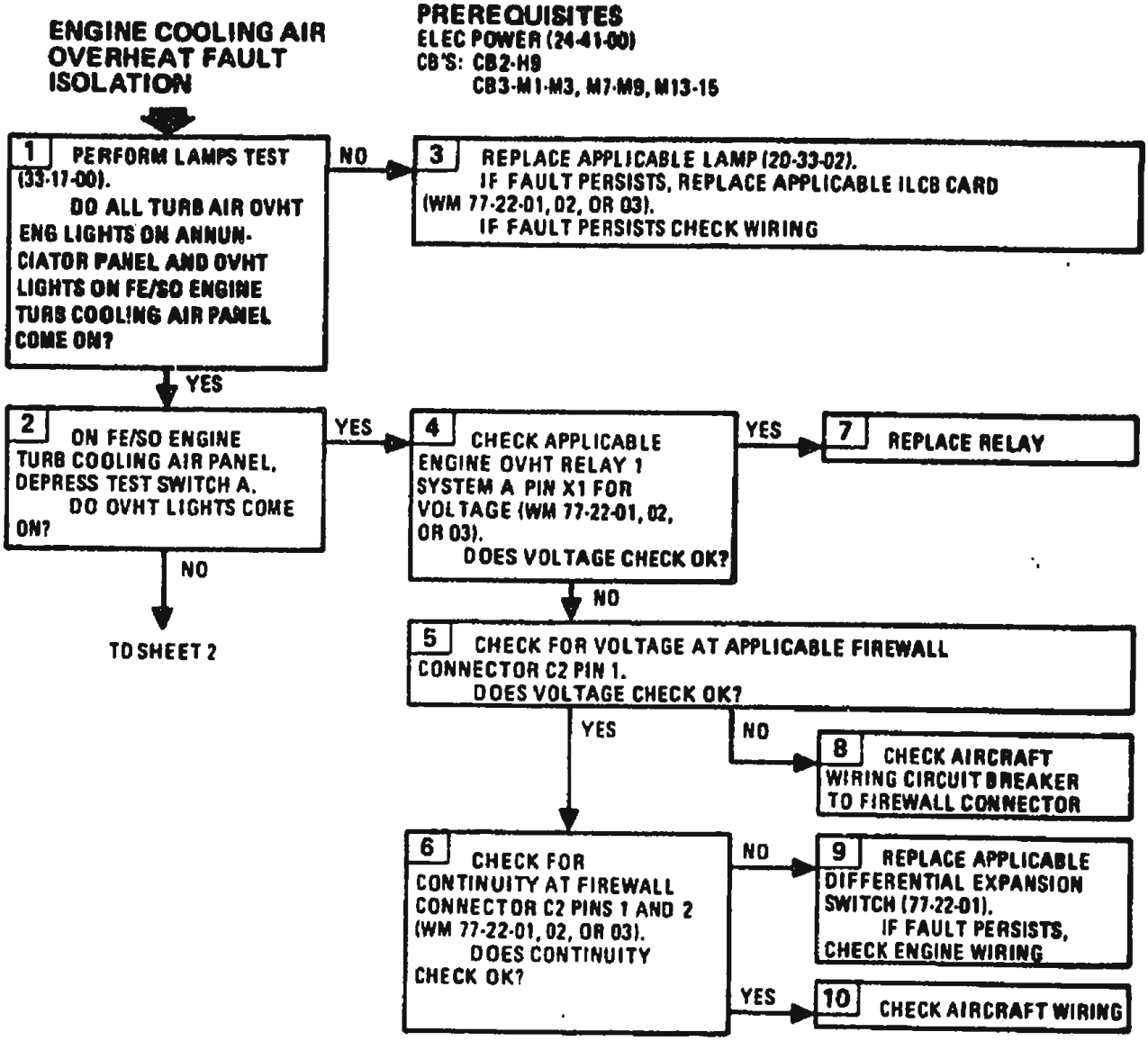
R
R Component Locator
Figure 102

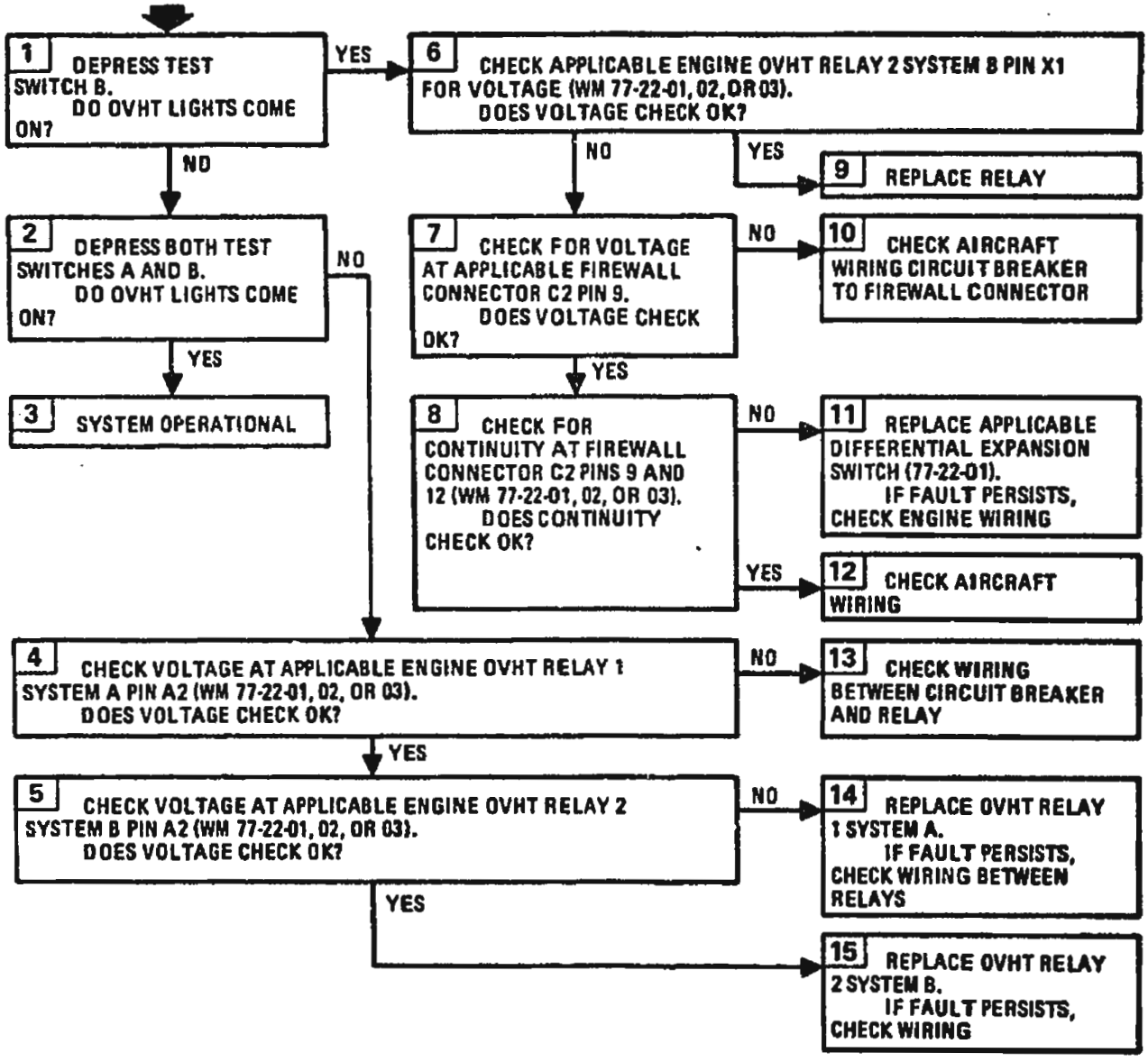
R EFFECTIVITY: ALL
R
001B


ENGINE COOLING AIR OVERHEAT FAULT ISOLATION
PREREQUISITES
ELEC POWER (24-41-00)
CB'S: CB2-H9
CB3-M1-M3, M7-M9, M13-15
1 PERFORM LAMPS TEST (33-17-00).
DO ALL TURB AIR OVHT ENG LIGHTS ON ANNUNCIATOR PANEL AND OVHT LIGHTS ON FE/SO ENGINE TURB COOLING AIR PANEL COME ON?
NO
3 REPLACE APPLICABLE LAMP (20-33-02).
IF FAULT PERSISTS, REPLACE APPLICABLE ILCB CARD (WM 77-22-01, 02, OR 03).
IF FAULT PERSISTS CHECK WIRING
YES
2 ON FE/SO ENGINE TURB COOLING AIR PANEL, DEPRESS TEST SWITCH A.
DO OVHT LIGHTS COME ON?
YES
4 CHECK APPLICABLE ENGINE OVHT RELAY 1 SYSTEM A PIN X1 FOR VOLTAGE (WM 77-22-01, 02, OR 03).
DOES VOLTAGE CHECK OK?
YES
7 REPLACE RELAY
NO
TO SHEET 2
NO
5 CHECK FOR VOLTAGE AT APPLICABLE FIREWALL CONNECTOR C2 PIN 1.
DOES VOLTAGE CHECK OK?
YES
NO
8 CHECK AIRCRAFT WIRING CIRCUIT BREAKER TO FIREWALL CONNECTOR
6 CHECK FOR CONTINUITY AT FIREWALL CONNECTOR C2 PINS 1 AND 2 (WM 77-22-01, 02, OR 03).
DOES CONTINUITY CHECK OK?
NO
9 REPLACE APPLICABLE DIFFERENTIAL EXPANSION SWITCH (77-22-01).
IF FAULT PERSISTS, CHECK ENGINE WIRING
YES
10 CHECK AIRCRAFT WIRING

M1-0000-77-266

R Engine Cooling Air Overheat Fault Isolation
R Figure 103 (Sheet 1)

PREREQUISITES
ELEC POWER (24-41-00)
CB'S: CB2-H9
CB3-M1-M3, M7-M9, M13-15

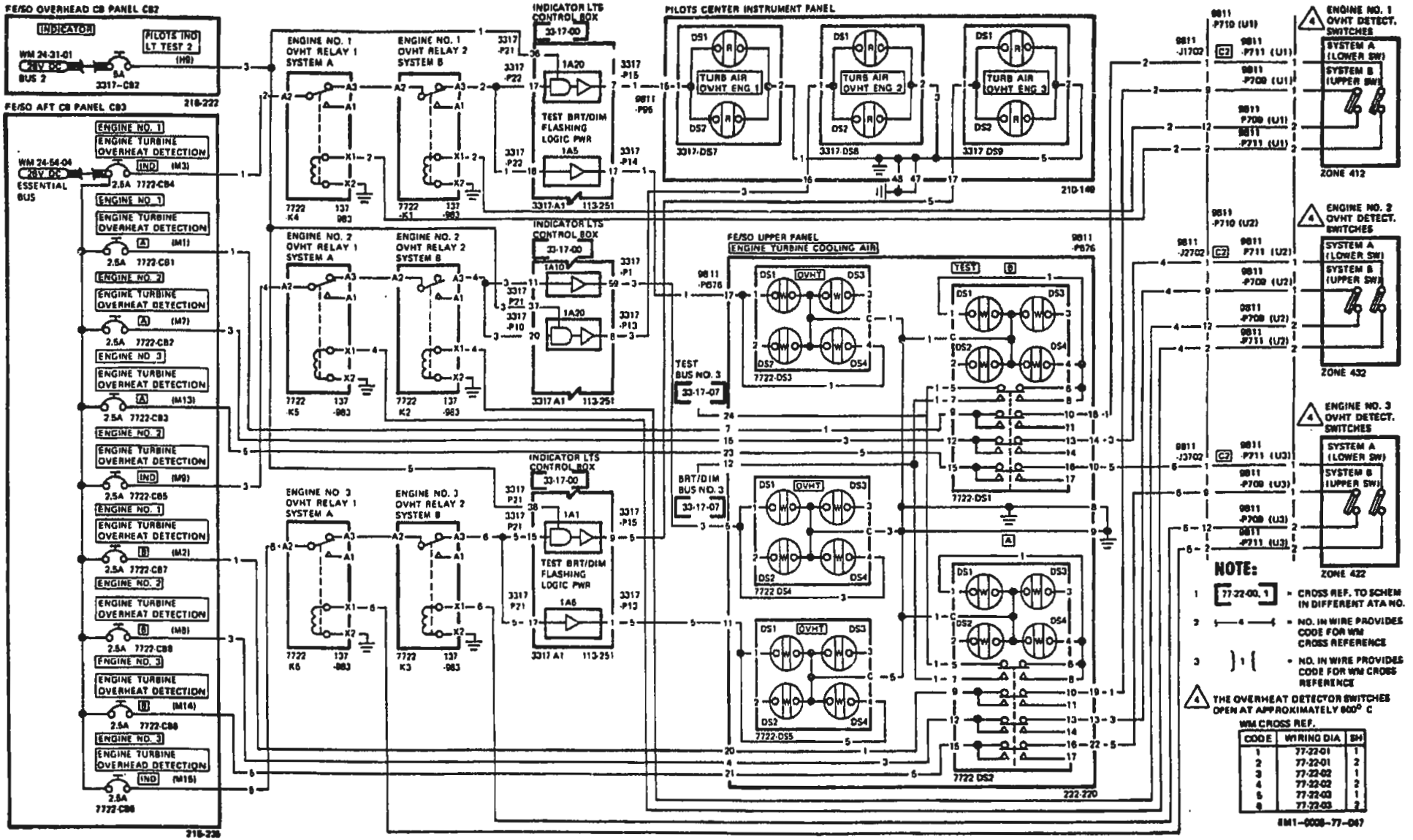

FROM SHEET 1
1 DEPRESS TEST SWITCH B. DO OVHT LIGHTS COME ON?
YES
NO
2 DEPRESS BOTH TEST SWITCHES A AND B. DO OVHT LIGHTS COME ON?
NO
YES
3 SYSTEM OPERATIONAL
6 CHECK APPLICABLE ENGINE OVHT RELAY 2 SYSTEM B PIN X1 FOR VOLTAGE (WM 77-22-01, 02, OR 03). DOES VOLTAGE CHECK OK?
NO
YES
9 REPLACE RELAY
7 CHECK FOR VOLTAGE AT APPLICABLE FIREWALL CONNECTOR C2 PIN 9. DOES VOLTAGE CHECK OK?
NO
10 CHECK AIRCRAFT WIRING CIRCUIT BREAKER TO FIREWALL CONNECTOR
YES
8 CHECK FOR CONTINUITY AT FIREWALL CONNECTOR C2 PINS 9 AND 12 (WM 77-22-01, 02, OR 03). DOES CONTINUITY CHECK OK?
NO
11 REPLACE APPLICABLE DIFFERENTIAL EXPANSION SWITCH (77-22-01). IF FAULT PERSISTS, CHECK ENGINE WIRING
YES
12 CHECK AIRCRAFT WIRING
4 CHECK VOLTAGE AT APPLICABLE ENGINE OVHT RELAY 1 SYSTEM A PIN A2 (WM 77-22-01, 02, OR 03). DOES VOLTAGE CHECK OK?
NO
13 CHECK WIRING BETWEEN CIRCUIT BREAKER AND RELAY
YES
5 CHECK VOLTAGE AT APPLICABLE ENGINE OVHT RELAY 2 SYSTEM B PIN A2 (WM 77-22-01, 02, OR 03). DOES VOLTAGE CHECK OK?
NO
14 REPLACE OVHT RELAY 1 SYSTEM A. IF FAULT PERSISTS, CHECK WIRING BETWEEN RELAYS
YES
15 REPLACE OVHT RELAY 2 SYSTEM B. IF FAULT PERSISTS, CHECK WIRING

M1-0002-77-132

R Engine Cooling Air Overheat Fault Isolation
R Figure 103 (Sheet 2)

EFFECTIVITY: ALL

001B


FE/SO OVERHEAD CB PANEL CB2
INDICATOR
PILOTS IND LT TEST 2
WM 24-31-01
28V DC
BUS 2
5A
3317-CB2
FE/SO AFT CB PANEL CB3
WM 24-54-04
28V DC
ESSENTIAL BUS
ENGINE NO. 1 ENGINE TURBINE OVERHEAT DETECTION IND (M3) 2.5A 7722-CB4
ENGINE NO. 1 ENGINE TURBINE OVERHEAT DETECTION A (M1) 2.5A 7722-CB1
ENGINE NO. 2 ENGINE TURBINE OVERHEAT DETECTION A (M7) 2.5A 7722-CB2
ENGINE NO 3 ENGINE TURBINE OVERHEAT DETECTION A (M13) 2.5A 7722-CB3
ENGINE NO. 2 ENGINE TURBINE OVERHEAT DETECTION IND (M9) 2.5A 7722-CB5
ENGINE NO. 1 ENGINE TURBINE OVERHEAT DETECTION B (M2) 2.5A 7722-CB7
ENGINE NO. 2 ENGINE TURBINE OVERHEAT DETECTION B (M8) 2.5A 7722-CB8
ENGINE NO. 3 ENGINE TURBINE OVERHEAT DETECTION B (M14) 2.5A 7722-CB6
ENGINE NO. 3 ENGINE TURBINE OVERHEAD DETECTION IND (M15) 2.5A 7722-CB9
ENGINE NO. 1 OVHT RELAY 1 SYSTEM A
ENGINE NO. 1 OVHT RELAY 2 SYSTEM B
ENGINE NO. 2 OVHT RELAY 1 SYSTEM A
ENGINE NO. 2 OVHT RELAY 2 SYSTEM B
ENGINE NO 3 OVHT RELAY 1 SYSTEM A
ENGINE NO. 3 OVHT RELAY 2 SYSTEM B
INDICATOR LTS CONTROL BOX 33-17-00
TEST BRT/DIM FLASHING LOGIC PWR
1A20
1A5
1A10
1A1
1A6
3317-A1
113-251
PILOTS CENTER INSTRUMENT PANEL
TURB AIR OVHT ENG 1
TURB AIR OVHT ENG 2
TURB AIR OVHT ENG 3
3317-DS7
3317-DS8
3317-DS9
210-140
FE/SO UPPER PANEL ENGINE TURBINE COOLING AIR
9811-P676
TEST BUS NO. 3 33-17-07
BRT/DIM BUS NO. 3 33-17-07
7722-DS3
7722-DS4
7722-DS1
7722-DS5
7722-DS2
222-220
9811-P710 (U1)
9811-P711 (U1)
9811-P709 (U1)
9811-J1702
9811-P710 (U2)
9811-P711 (U2)
9811-P709 (U2)
9811-J2702
9811-P710 (U3)
9811-P711 (U3)
9811-P709 (U3)
9811-J3702
ENGINE NO. 1 OVHT DETECT. SWITCHES
ENGINE NO. 2 OVHT DETECT. SWITCHES
ENGINE NO. 3 OVHT DETECT. SWITCHES
SYSTEM A (LOWER SW)
SYSTEM B (UPPER SW)
ZONE 412
ZONE 432
ZONE 422
NOTE:
77-22-00, 1 = CROSS REF. TO SCHEM IN DIFFERENT ATA NO.
= NO. IN WIRE PROVIDES CODE FOR WM CROSS REFERENCE
= NO. IN WIRE PROVIDES CODE FOR WM CROSS REFERENCE
4 THE OVERHEAT DETECTOR SWITCHES OPEN AT APPROXIMATELY 800° C
WM CROSS REF.
CODE | WIRING DIA | SH
1 | 77-22-01 | 1
2 | 77-22-01 | 2
3 | 77-22-02 | 1
4 | 77-22-02 | 2
5 | 77-22-03 | 1
6 | 77-22-03 | 2
SM1-0008-77-047

Engine Cooling Air Overheat Schematic
SCHEM 1

R EFFECTIVITY: ALL
R
001B

ENGINE TURBINE COOLING AIR OVERHEAT INDICATING SYSTEM MAINTENANCE PRACTICES

1. General

The following procedure specifies the method used to deactivate one channel (A or B) of the engine cooling air overheat indicating system.

2. Deactivation

NOTE: This deactivation procedure applies only when an aircraft is to be dispatched in accordance with the MEL.

R A. Channel Operation Verification

R NOTE: The following steps are to be performed to verify the
R operational status of the unaffected channel(s) and
R confirm the inoperative channel(s).

R (1) Open and tag circuit breaker of inoperative channel(s).

R A-Channel CB 3M-1 (Engine 1)

R A-Channel CB 3M-7 (Engine 2)

R A-Channel CB 3M-13 (Engine 3)

R B-channel CB 3M-2 (Engine 1)

R B-Channel CB 3M-8 (Engine 2)

R B-Channel CB 3M-14 (Engine 3)

R NOTE: When the inoperative channel CB is opened, the
R OVHT and associated TURB AIR OVHT ENG lights for
R that engine will illuminate if the other channel
R is not operative (indicating both channels
R inoperative).

R (2) If no lights illuminate with affected channel CBs open,
R test the Engine Turbine Cooling Air Overheat Detect
R System:

R (a) Press and hold A-channel test switch.

R (b) OVHT and associated TURB AIR OVHT ENG lights will
R illuminate for any engine with a failed A-channel
R (A-channel CB open).

R (c) Lights should not illuminate for engine with an
R operative A-channel.

R (d) Release A-channel test switch.

R (e) Press and hold B-channel test switch.

R (f) OVHT and associated TURB AIR OVHT ENG lights
R should illuminate for any engine with a failed
R B-channel (B-channel CB open).

R (g) Lights should not illuminate for engines with an
R operative B-channel.

R (h) Press both test switches.

R (i) All 3 OVHT and all 3 TURB AIR OVHT ENG lights
R should illuminate.

R NOTE: When operating on only one turbine air
R overheat detect channel, the OVHT and
R associated TURB AIR OVHT ENG lights will
R illuminate if an overheat is sensed by the
R operative channel. Treat all such
R indications as valid overheat warnings.

R B. Channel Deactivation

R NOTE: This deactivation procedure applies only when an
R aircraft is to be dispatched in accordance with the
R MEL.

R (1) On Flight Engineer/Second Officers aft circuit breaker
R panel CB3, zone 215, open and tag applicable circuit
R breaker ENG TURBINE OVHT DETECTION A or B (M1, M2, M7,
R M8, M13, or M14).

R (2) Make appropriate entry in aircraft log book.

DIFFERENTIAL EXPANSION SWITCH - REMOVAL AND INSTALLATION

1. Equipment and Materials

Work Platform, Rolls-Royce Ltd., PN CP.20309, or PN XUT.42526 Spacer and XUT.42527 Side Piece, or equivalent

2. Referenced Procedures

24-41-00	External Power/Ground Service System - Maintenance Practices
72-03-00	Gas Generator Fairings - Maintenance Practices
78-30-00	Thrust Reverser - Maintenance Practices

3. Removal/Installation

WARNING: DO NOT ENTER COLD STREAM NOZZLE UNTIL THRUST REVERSER SYSTEM IS LOCKED IN THE FORWARD-THRUST POSITION.

A. Removal

(1) Lock thrust reverser system in forward-thrust position (Ref. 78-30-00).

(2) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag applicable circuit breakers ENG TURBINE OVHT DETECTION A, B, and IND (M1, M2, and M3, or M7, M8, and M9, or M13, M14 and M15) for the affected engine (Ref. Fig. 401).

On pilots overhead circuit breaker panel CB1, zone 210, open and tag applicable circuit breaker ENGINE START CONT (E13, E14, or E15).

(3) Remove turbine section lower fairing and turbine section LH side fairing (Ref. 72-03-00).

(4) Install work platform segments in cold stream collector and nozzle.

R CAUTION: ENSURE ELECTRICAL TERMINALS ARE FREE OF LIQUID AND/OR SOLID CONTAMINATION BEFORE DISCONNECTING.

(5) Remove terminal nuts and cable terminals from switch terminal posts (Ref. Fig. 401).

(6) Remove securing bolts and remove expansion switch from mixing block.

(7) Install approved blanking plate on mixing block to cover openings.

B. Installation

(1) Verify that thrust reverser system is locked in forward-thrust position (Ref. 78-30-00).

(2) Verify that circuit breakers opened in Step 3A(2) are open and tagged.

(3) Verify that work platform installed in Step 3A(7) is in place.

(4) Remove blanking plate from differential expansion switch mixing block.

R (5) Perform the following:

R (a) Inspect mounting face of mixing block to ensure
R that the surface is clean and undamaged.

R (b) Install expansion switch and secure with bolts (Ref. Fig. 401).

CAUTION: ENSURE ELECTRICAL TERMINALS ARE FREE OF LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

R (6) Install cable terminals and secure with terminal nuts.

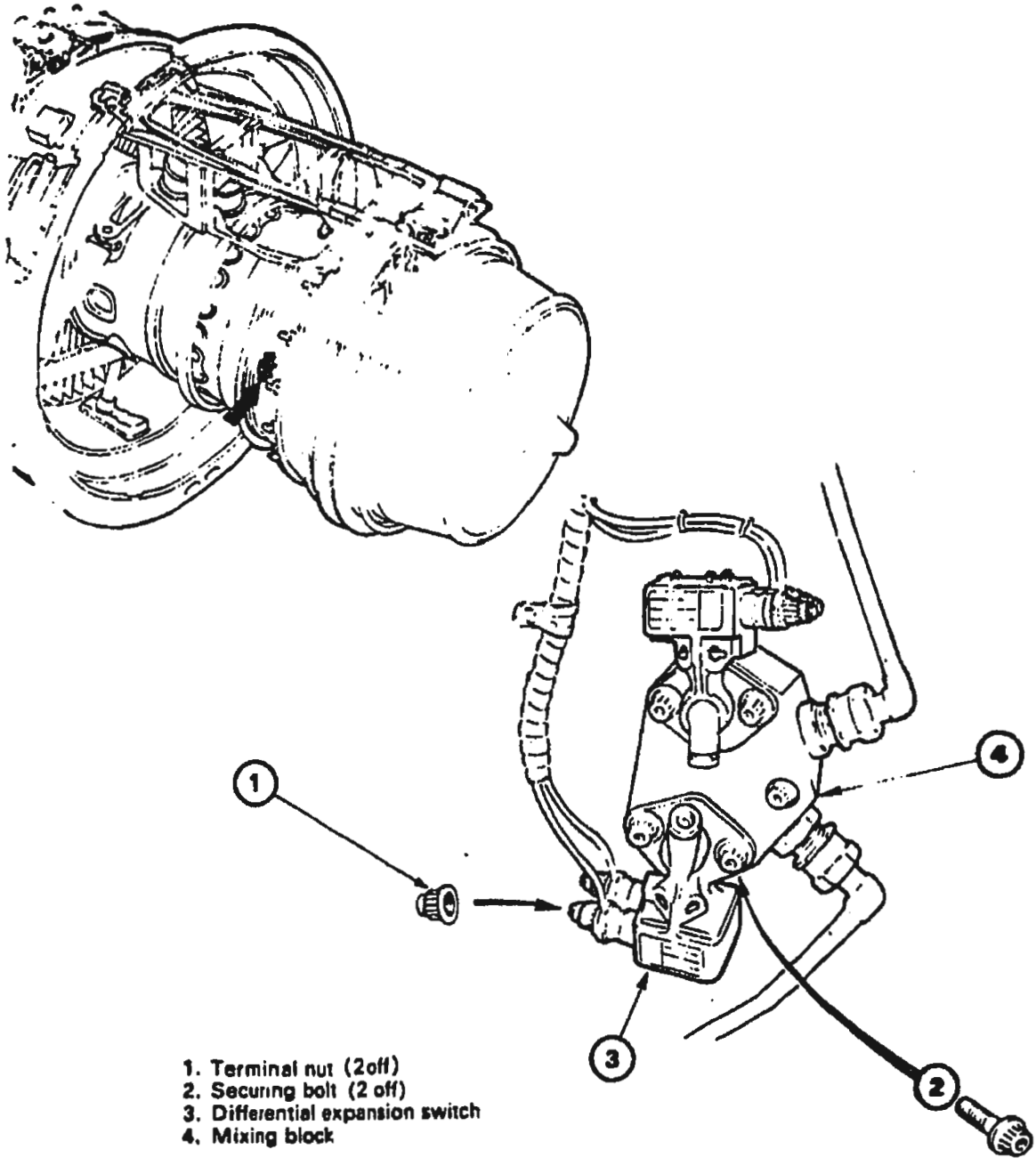
R (7) Remove work platform.

R (8) Remove tags and close circuit breakers ENG TURBINE OVHT DETECTION A, B, and IND opened in Step 3A(1).

R (9) Turn on electrical power (Ref. 24-41-00) and perform system test as follows:

(a) On ENGINE TURB COOLING AIR panel at Flight Engineer/Second Officers station, zone 215, depress TEST A switchlight. Overheat indicator light on that panel and equivalent indicator light on pilots center instrument panel, zone 210, must not come on.

NOTE: Depressing TEST switch A disables the B circuit so that a fault in any A circuit (relay, overheat switch, etc) will illuminate the applicable engine OVHT



1. Terminal nut (2off)
2. Securing bolt (2 off)
3. Differential expansion switch
4. Mixing block

HH9565
M1-0100-77-201
25463

Differential Expansion Switch - Removal and Installation
Figure 401

light. TEST switch B operates correspondingly.

(b) Repeat the same test by depressing the TEST B switchlight.

(c) Depress TEST A and B switchlights simultaneously. Overheat warning indicator lights for affected engine must come on at pilots station and at Flight Engineer/Second Officers station. Lights must go out when test switchlights are released.

R (10) Turn off electrical power (Ref. 24-41-00).

R (11) Install turbine section lower fairing and turbine section LH fairing removed in Step 3A(4).

R (12) Remove tags and close circuit breakers ENGINE START CONT and THRUST REVERSE opened in Step 3A(2).

R (13) Unlock thrust reverser system (Ref. 78-30-00).

ENGINE TURBINE COOLING AIR PANEL ASSEMBLY REMOVAL AND INSTALLATION

1. Referenced Procedure

   21-41-00 External Power/Ground Service System - Maintenance Practices

2. Removal/Installation

   A. Removal

      (1) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag applicable circuit breakers ENG TURBINE OVHT DETECTION A, B, and IND (M1, M2, and M3, or M7, M8 and M9, or M13, M14, and M15).

      On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breaker F/E PNL (E2).

      (2) Locate the ENGINE TURB COOLING AIR panel at the top of the Flight Engineer/Second Officers station, zone 215, and loosen captive triwing fastener (Ref. Fig. 401).

      (3) Slide panel assembly out from console opening, and disconnect electrical harness connector from panel connector.

      NOTE: Front panel removal for switchlight bulb replacement may be performed without removing control panel assembly.

   B. Installation

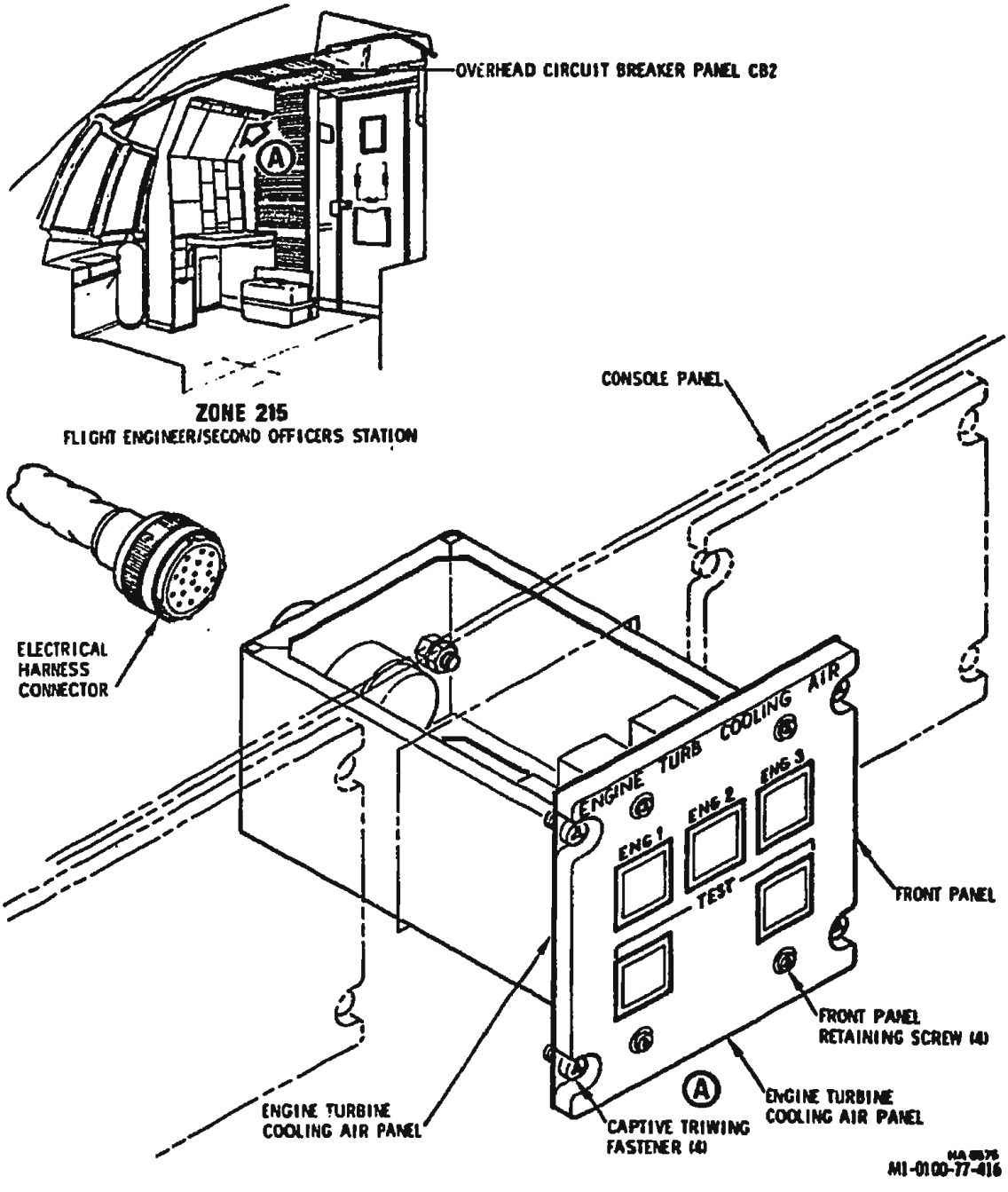
      (1) Verify that circuit breakers opened in Step 2A(1) are open and tagged.

      (2) Mate electrical harness connector to COOLING AIR panel assembly connector.

      (3) Slide panel assembly into console opening. Secure panel assembly by tightening captive triwing fasteners.

      (4) Remove tags and close circuit breakers opened in Step 2A(1).

      (5) Turn on electrical power (Ref. 24-41-00) and perform system test as follows:



Engine Turbine Cooling Air Panel Assembly
Removal and Installation
Figure 401

(a) On ENGINE TURB COOLING AIR panel at Flight Engineer/Second Officers station, zone 215, depress TEST A switchlight. Overheat indicator light on that panel and equivalent indicator light on pilots center instrument panel, zone 210, must not come on.

NOTE: Depressing TEST switch A disables the B circuit so that a fault in any A circuit (relay, overheat switch, etc) will illuminate the applicable engine OVHT light. TEST switch B operates correspondingly.

(b) Repeat the same test by depressing the TEST B switchlight.

(c) Depress TEST A and B switchlights simultaneously. Overheat warning indicator lights for affected engine must come on at pilots station and at Flight Engineer/Second Officers station. Lights must go out when test switchlights are released.

(6) Turn off electrical power (Ref. 24-41-00).

ANALYZERS - DESCRIPTION AND OPERATION

1. General

The engine analyzers consist of a vibration monitoring system. Engine vibration is an indication of engine condition. A sudden or progressive change in vibration indicates abnormal engine operation, which can be induced by a single unit malfunction or a combination of failures.

VIBRATION MONITOR SYSTEM - DESCRIPTION AND OPERATION

1. General

The purpose of the VM system is to sense and measure vibrations originating in the rotating components of the engine.

The system (Ref. Fig. 1) consists of an indicator, warning lights, a pair of transducers (accelerometers, pickups) for each engine and a signal-conditioning unit common to all engines. The signal-conditioning unit is mounted on a rack in the mid electrical service center, zone 138. The indicators and switches are mounted on the Flight Engineer/Second Officers ENGINE STATUS panel, zone 215.

On aircraft 001-031 without SB77-038, a system test switch is provided, and two latching type momentary-contact switchlights permit transient monitoring of front or rear transducers independently.

On aircraft 001-031 with SB77-038 and 032-999, a system test switch is provided and two latching type momentary-contact switchlights permit transient monitoring of corresponding "A" or "B" transducers independently.

A rotary switch is provided for filter selection. Both transducers are mounted directly on the engine, Zones 412, 422 or 432. On engines without RR SB72-3310 and RR SB77-4644, one transducer is located on the IP compressor case left-hand side (viewed from the rear) and one on the IP turbine case right-hand side. Each transducer is connected to a junction box in the interservices fairing (Ref. Fig. 2).

NOTE: On engines without RR SB77-3254, the rearmost junction box is located on the splitter disconnect bulkhead front face (Ref. Fig. 2).

On engines with RR SB77-3254, the rearmost junction box is relocated on the splitter disconnect bulkhead rear face and rotated through 90 degrees (Ref. Fig. 2).

On engines without RR SB72-3310, with RR SB77-4644, the IP turbine case transducer is relocated on the IP compressor case left-hand side below the original IP compressor case transducer. The junction boxes remain in position in the interservices fairing (Ref. Fig. 2).

On engines with RR SB72-3310, without RR SB77-4644, the IP compressor case transducer is relocated on the IP

compressor case right-hand side. The other transducer remains in position on the IP turbine case right-hand side and both junction boxes remain in position in the interservices fairing (Ref. Fig. 2).

On engines with RR SB72-3310 and RR SB77-4644,
both transducers are relocated adjacent to each other on the IP compressor case right-hand side. The junction boxes remain in position in the interservices fairing (Ref. Fig. 2).

On engines with RR SB72-3310 and RR SB72-3732,
the IP turbine case transducer remains in position on the IP turbine case right-hand side and the IP compressor case transducer remains in position on the IP compressor case right-hand side but is rotated through 180 degrees (Ref. Fig. 2). The junction boxes are deleted.

On engines with RR SB77-5387,
both transducers are located adjacent to each other and both junction boxes are located adjacent to each other on the IP compressor case right-hand side (Ref. Fig. 2).

On engines without RR SB72-3732,
the transducers, fitted with an integral mineral insulated (M.I.) cable, are connected to junction boxes in the interservices fairing and from there by flexible, anti-microphonic cable to the engine/aircraft interface.

On engines with RR SB72-3732,
the transducers are connected by flexible, anti-microphonic cable direct to the engine aircraft interface thus deleting the junction boxes (Ref. Fig. 2).

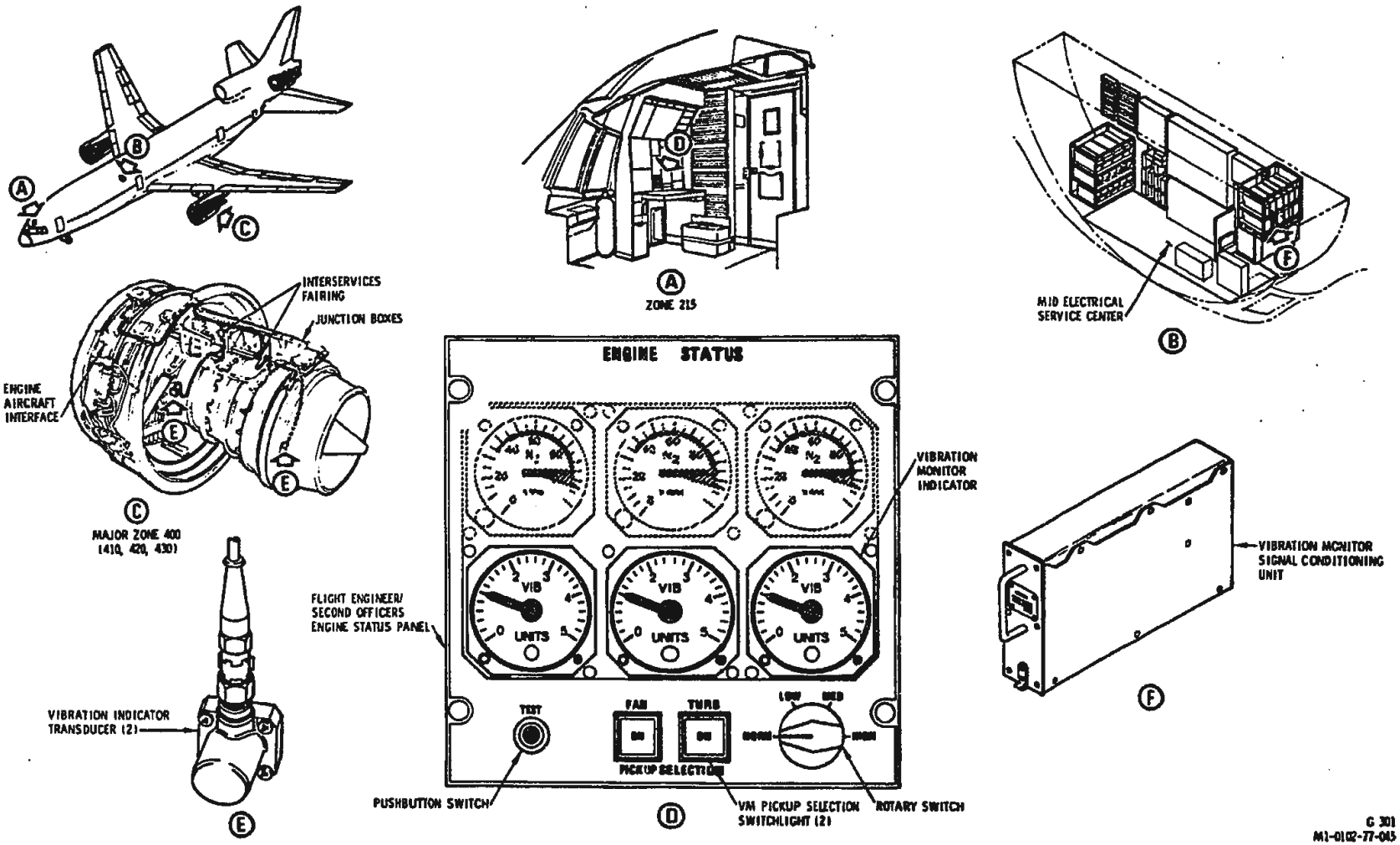
On engines with RR SB77-5387,
the transducers are connected by integral mineral insulated (M.I.) cable to the junction boxes, from there, they are connected by flexible anti-microphonic cable to the engine/aircraft interface.

2. Operation

A. Circuit Operation

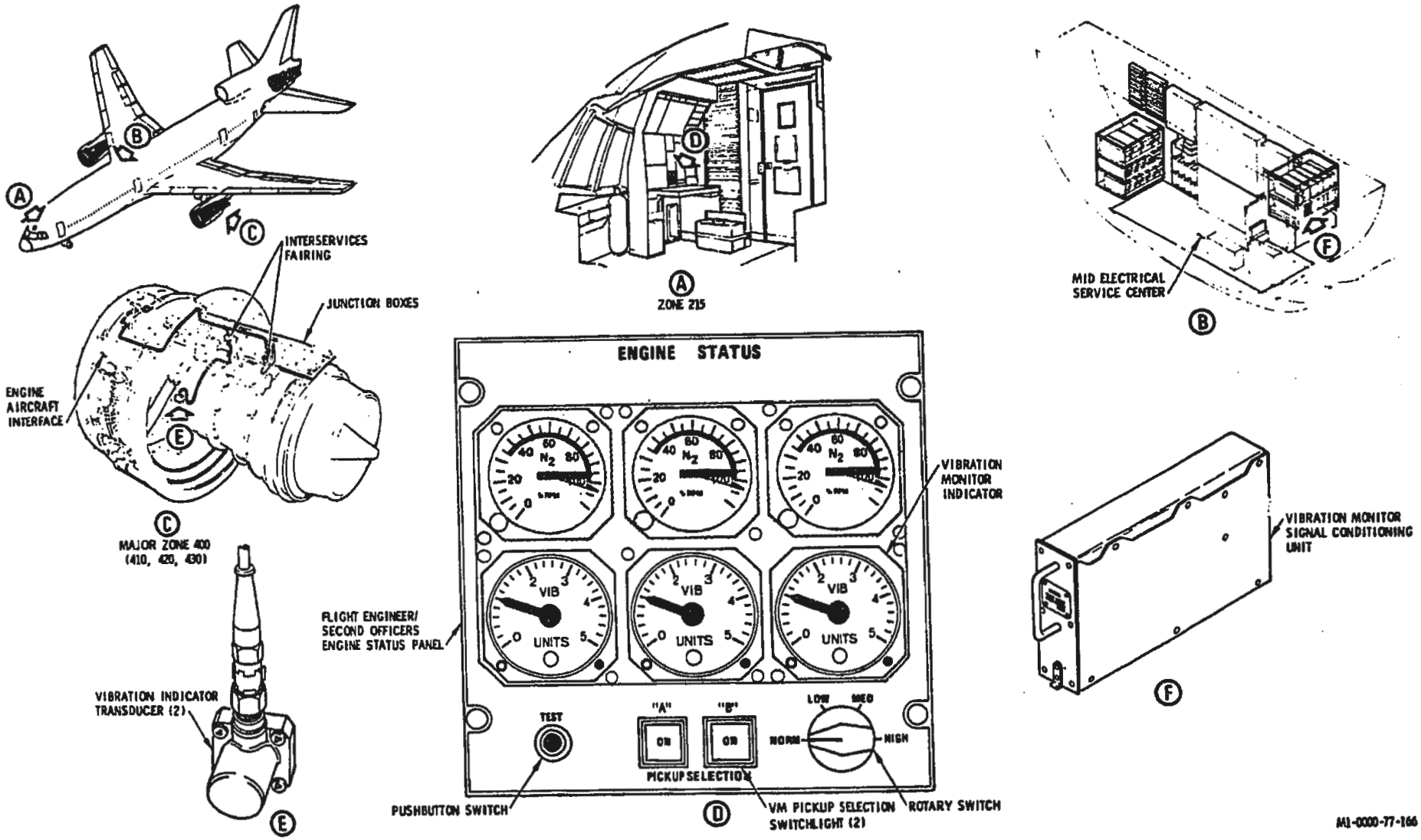
On aircraft 001-031 without SB77-038,
the vibration transducers monitor vibration levels at the front [intermediate-pressure (IP) compressor] and rear (IP turbine) modules of each engine.

On aircraft 001-031 with SB77-038 and 032-999,
the vibration transducers monitor vibration levels at the intermediate-pressure (IP) compressor of each engine. The



Vibration Monitor System Components
Figure 1

R
R
001B EFFECTIVITY: 001-031 WITHOUT SB77-038



R R Vibration Monitor System Components
Figure 1

R R 001B EFFECTIVITY: 001-031 WITH SB77-038 AND 032-999

output signals of these transducers are alternately connected to the signal conditioning circuitry of the respective engine channel by an automatic duplexing system (Ref. Fig. 3). The sample period is nominally 0.5 second. The VM indicators display an average of the vibration sensed by both the front and rear transducers.

On aircraft 001-031 without SB77-038, the FAN or TURB PICKUP SELECTION switchlights on the ENGINE STATUS panel are used to cancel out the duplexing in either the front or rear position.

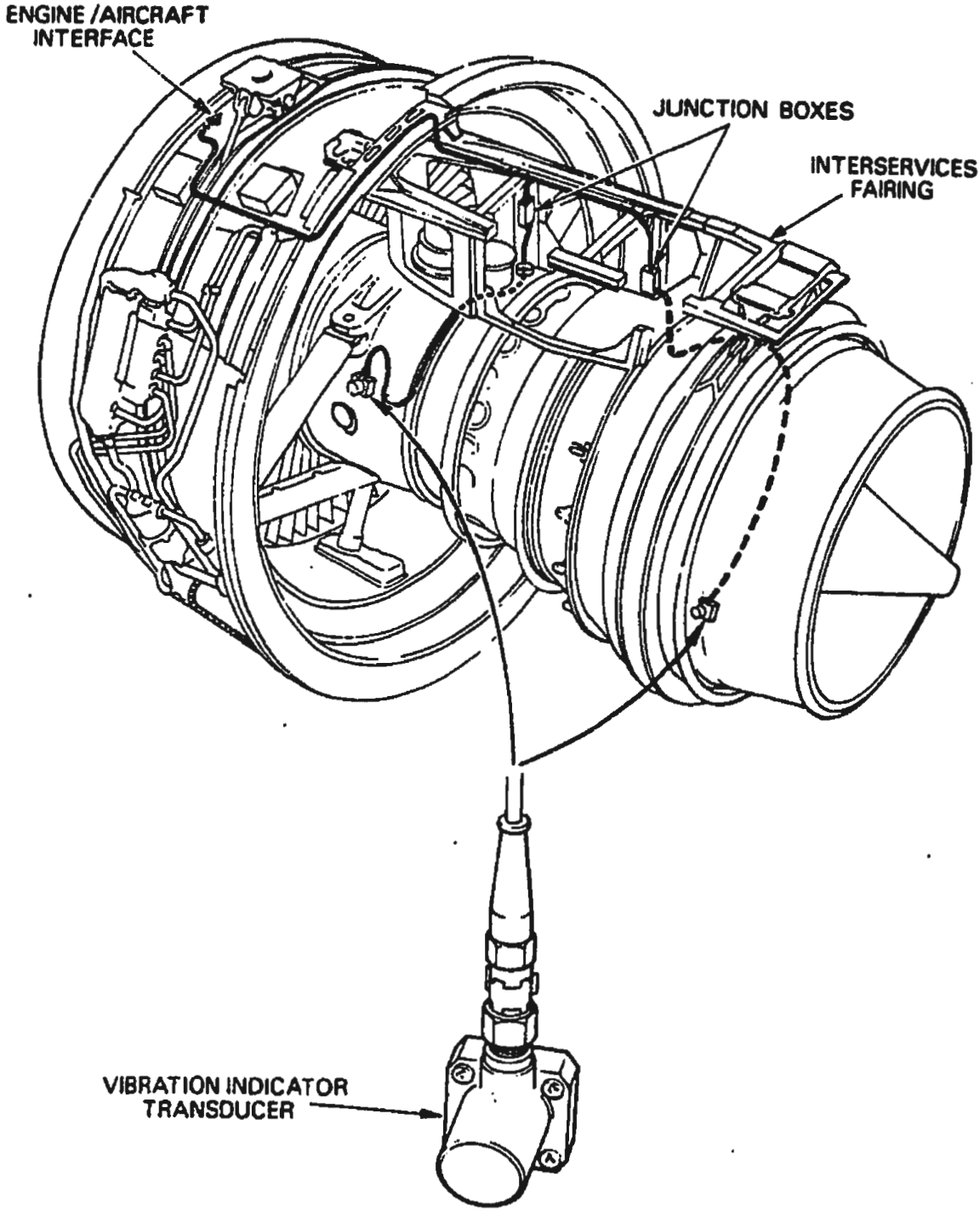
On aircraft 001-031 with SB77-038 and 032-999, the "A" or "B" PICKUP SELECTION switchlights on the ENGINE STATUS panel are used to cancel out the duplexing in either the "A" or "B" position.

On aircraft 001-031 without SB77-038, when the FAN switchlight is depressed, the front transducer on each of the three engines is connected to its related engine channel, and the vibration level of each front transducer is continuously displayed on the applicable VM indicator. When the TURB switchlight is depressed, the rear transducer on each engine transmits a signal to the applicable VM indicator for display. When these respective switchlights are released, normal duplexing takes place. The VM indicators then display the average of the vibration levels sensed by the paired transducers on the three engines (Ref. Fig. 4).

On aircraft 001-031 with SB77-038 and 032-999, when the "A" or "B" switchlight is depressed, the corresponding transducer on each of the three engines is connected to its related engine channel, and the vibration level of each corresponding transducer is continuously displayed on the applicable VM indicator. When these respective switchlights are released, normal duplexing takes place. The VM indicators then display the average of the vibration levels sensed by the paired transducers on the three engines (Ref. Fig. 4).

The filter selector rotary switch selects, for display, one of the four filter bands of each engine channel. Filter selection for all three channels occurs simultaneously.

R When the rotary switch is placed in the NORM position, the
R output of a broadband filter is mathematically processed and
R all VM indicators display the mean level of the broadband
R vibrations of the respective engines. This is usually on
R approximation of the highest of the three individual
R frequencies. When the rotary switch is placed in the LOW position, the VM indicators display vibration emanating from the LP section of each engine. When the rotary switch is



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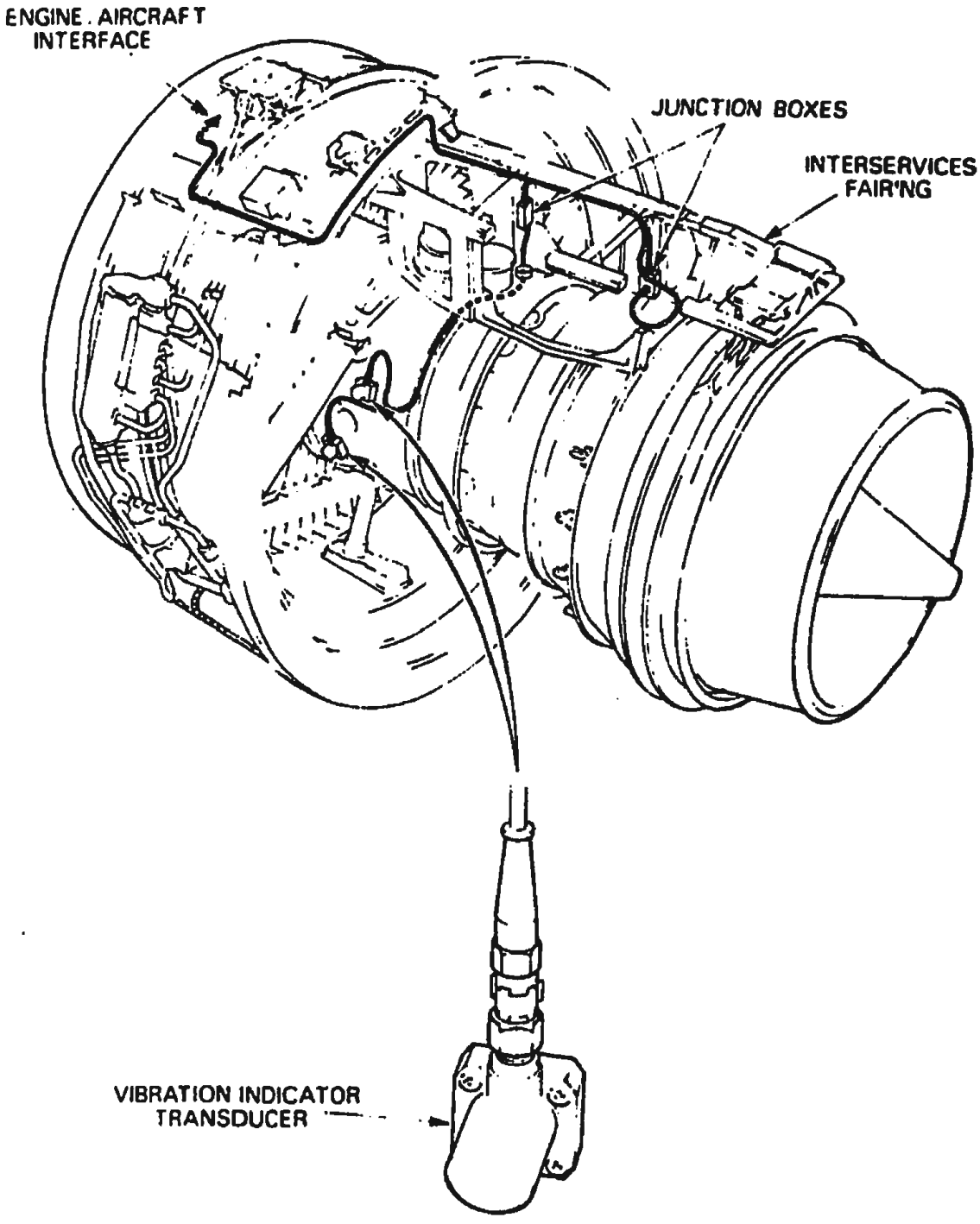
R Vibration Monitor System Engine Units
R Figure 2

EFFECTIVITY: ENGINES WITHOUT RR SB72-3310,
RR SB77-3254 AND RR SB77-4644

001B

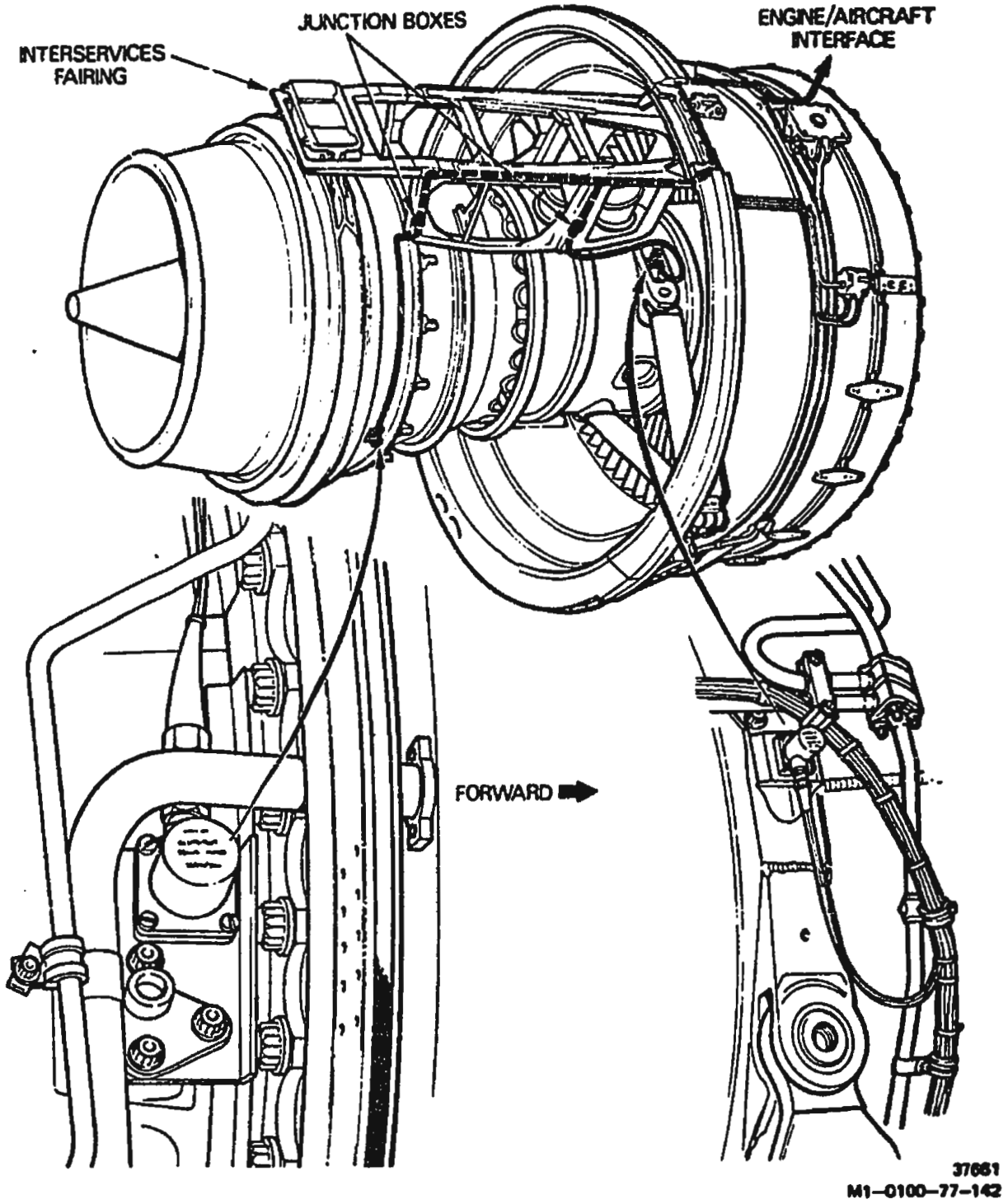


R
R

Vibration Monitor System Engine Units
Figure 2

EFFECTIVITY: ENGINES WITHOUT RR SB72-3310,
WITH RR SB77-4644 AND RR SB77-3254

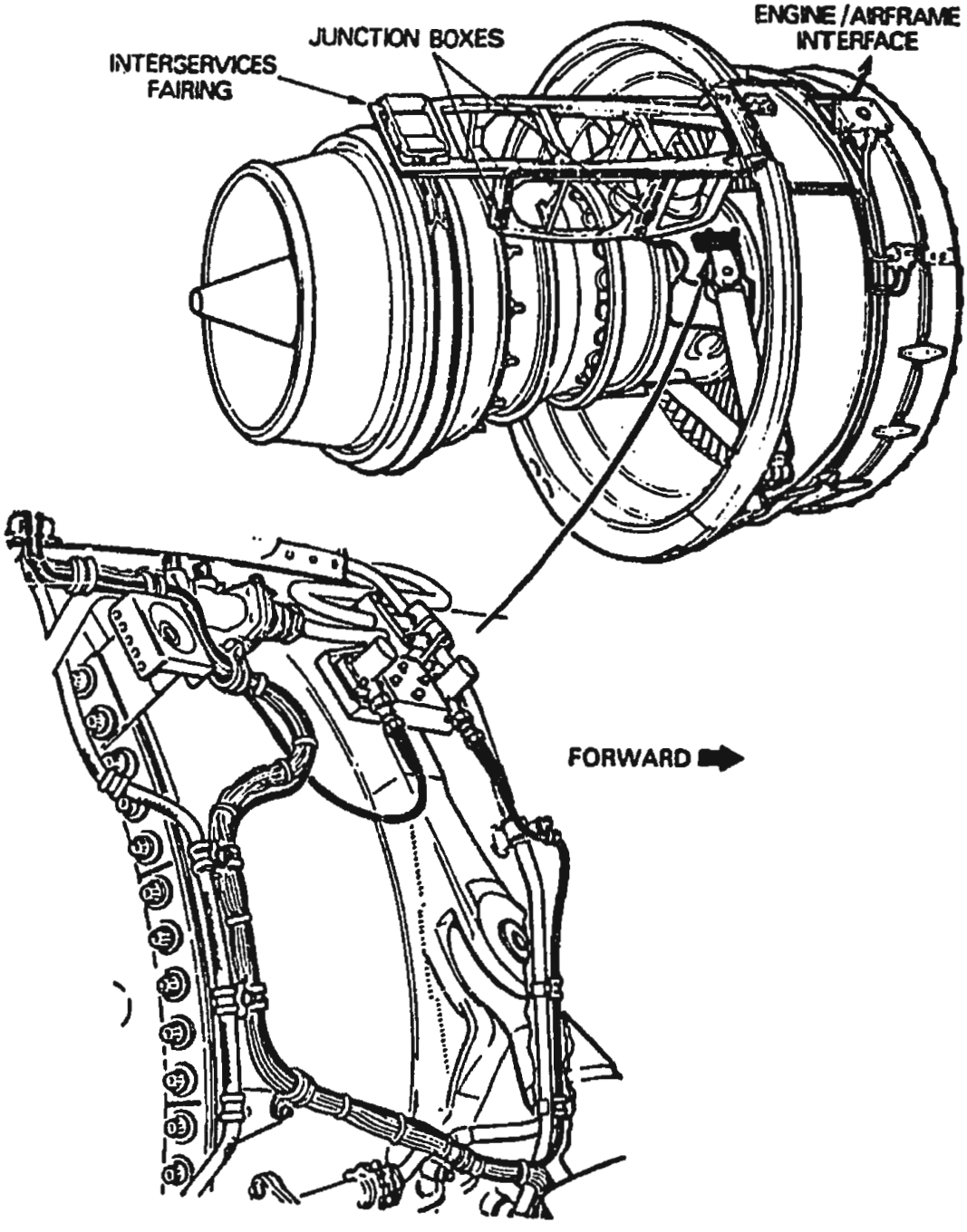
001B



R
R
Vibration Monitor System Engine Units
Figure 2

EFFECTIVITY: ENGINES WITH RR SB72-3310, WITHOUT RR SB77-4644 AND RR SB77-3732

001B



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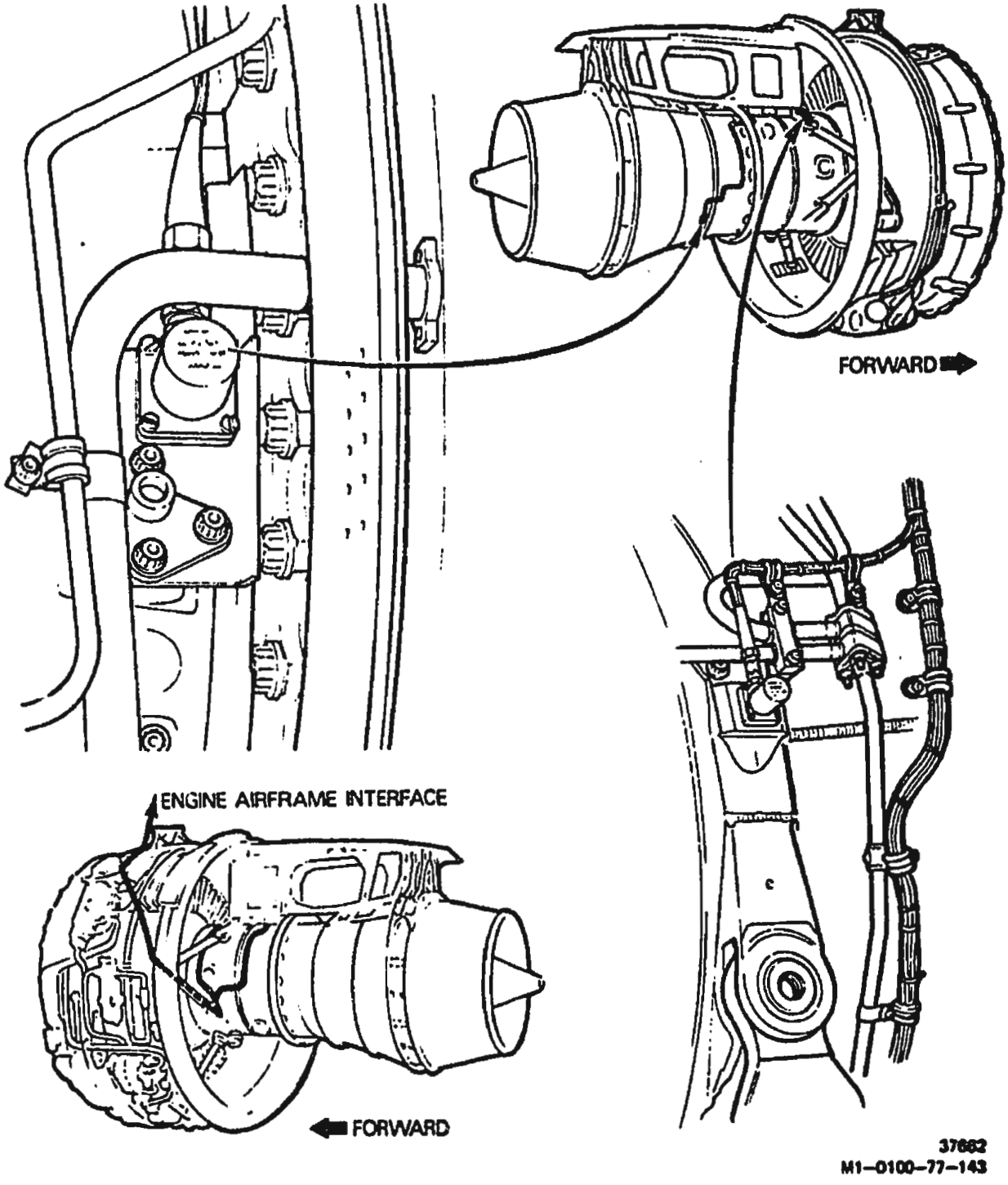
R Vibration Monitor System Engine Units
R Figure 2

R EFFECTIVITY: ENGINES WITH RR SB72-3310 AND
R RR SB77-4644, WITHOUT RR SB72-3732

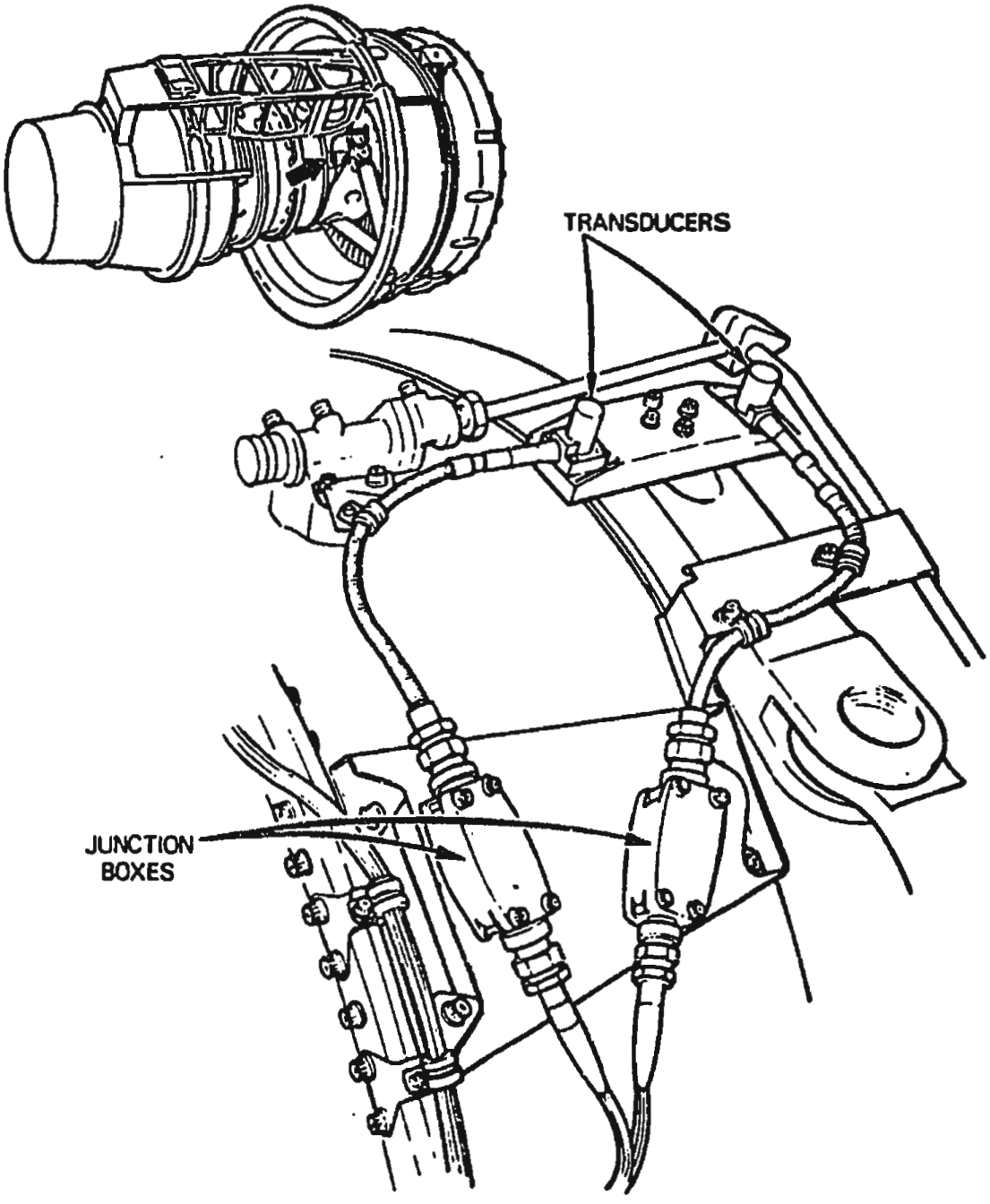
001B



R Vibration Monitor System Engine Units
R Figure 2

R EFFECTIVITY: ENGINES WITH RR SB72-3310 AND
R RR SB72-3732

001B



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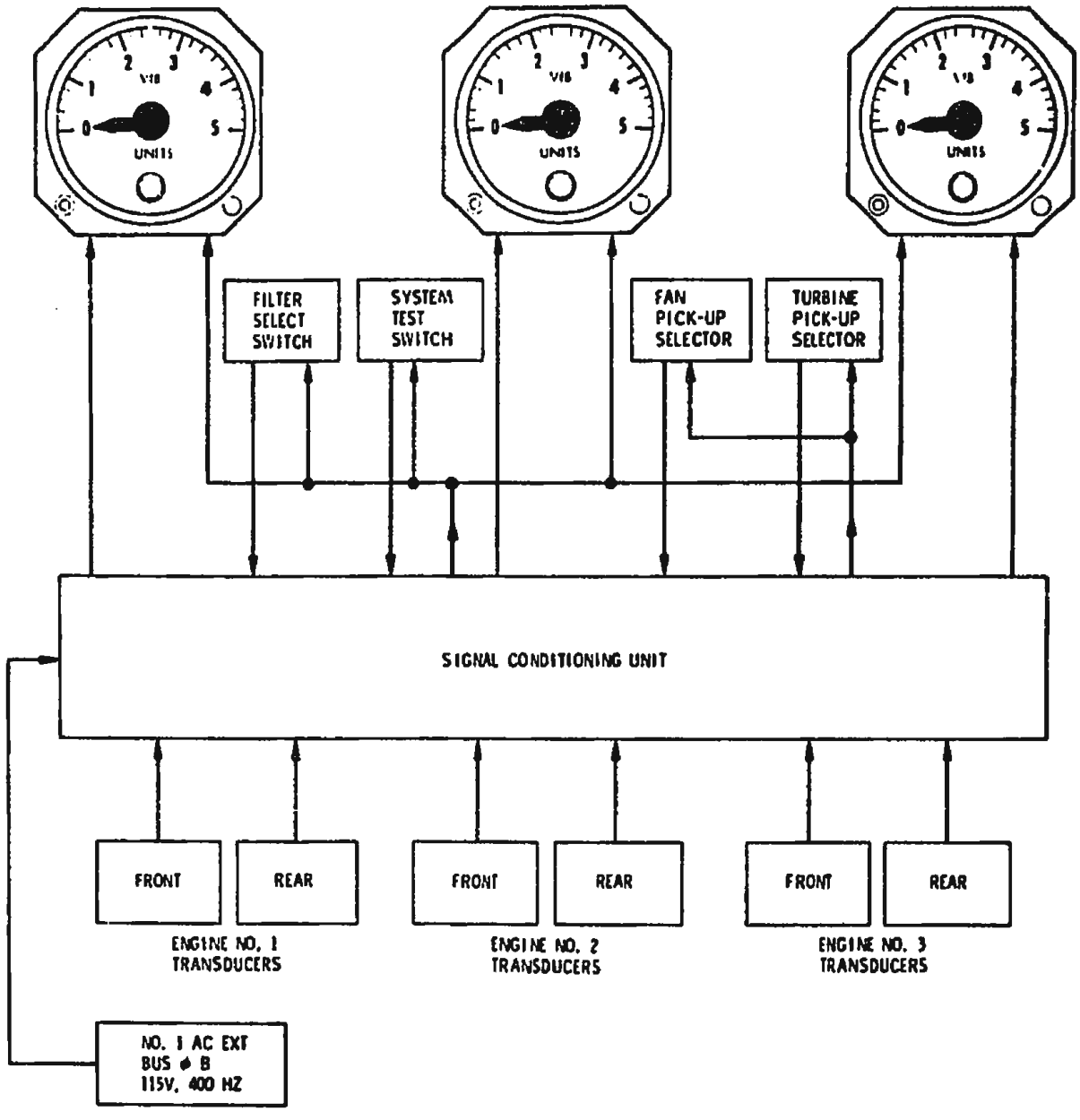
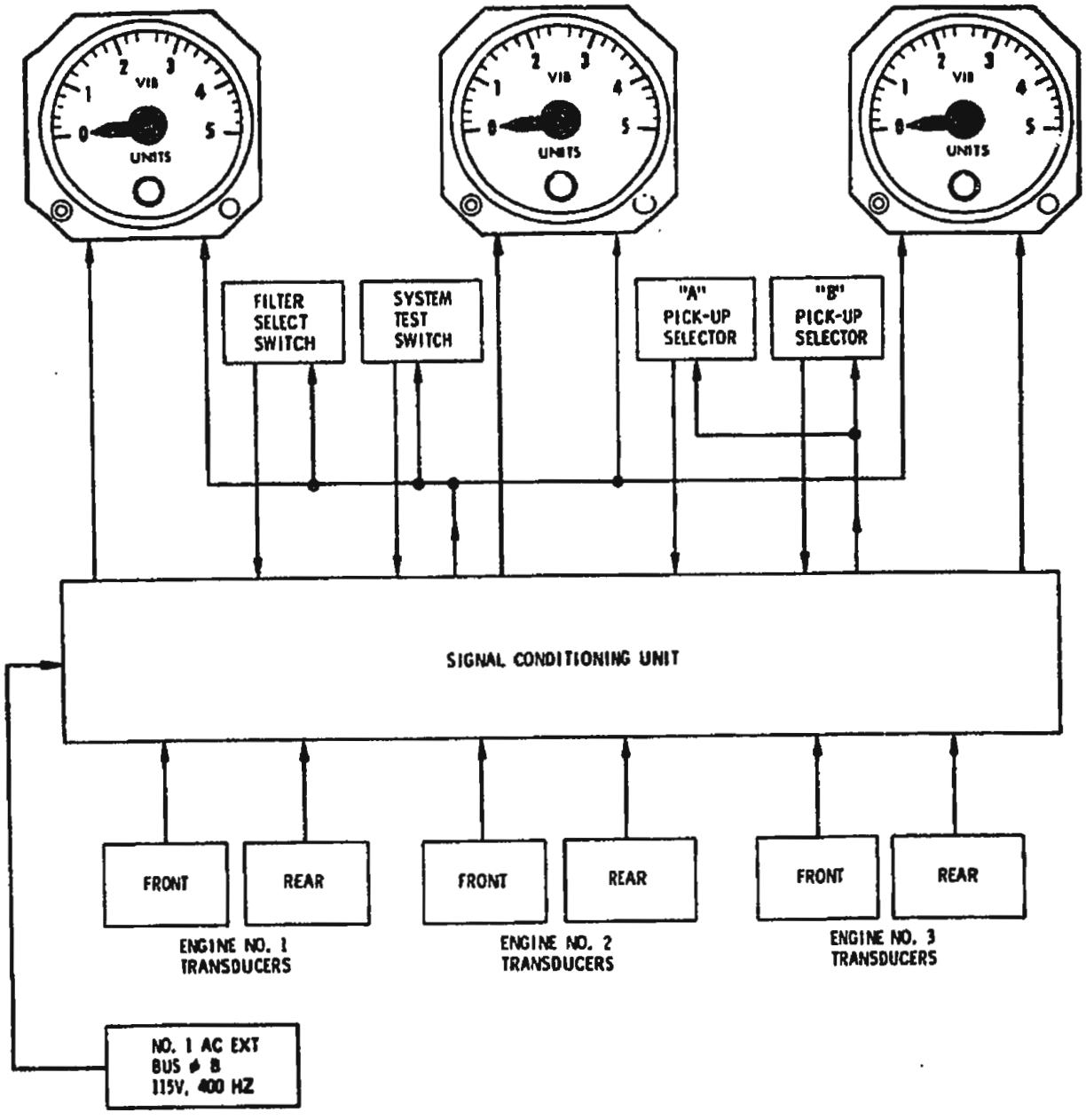
R Vibration Monitor System Engine Units
R Figure 2

R EFFECTIVITY: ENGINES WITH RR SB77-5387
R
0018



HH 4875
A11-A00-77-034

Vibration Monitor System Block Diagram
Figure 3



M1-0000-77-165

Vibration Monitor System Block Diagram
Figure 3

placed in the MED position, the VM indicators display vibration emanating from the intermediate-pressure (IP) section of each engine. When the switch is placed in the HIGH position, the VM indicators display vibration occurring in the HP section of each engine. The filter selector switch also presets the self-test system to the proper test signal amplitude and frequency.

The TEST pushbutton switch applies a self-test signal to the system to check for correct functioning of all channels. Appropriate test signal frequencies and amplitudes for all filter channels are preset by the filter selector rotary switch position. Each VM indicator is provided with a built-in-test-equipment (BITE) switch for verification of correct functioning of indicator and associated alarm light.

B. System Operation

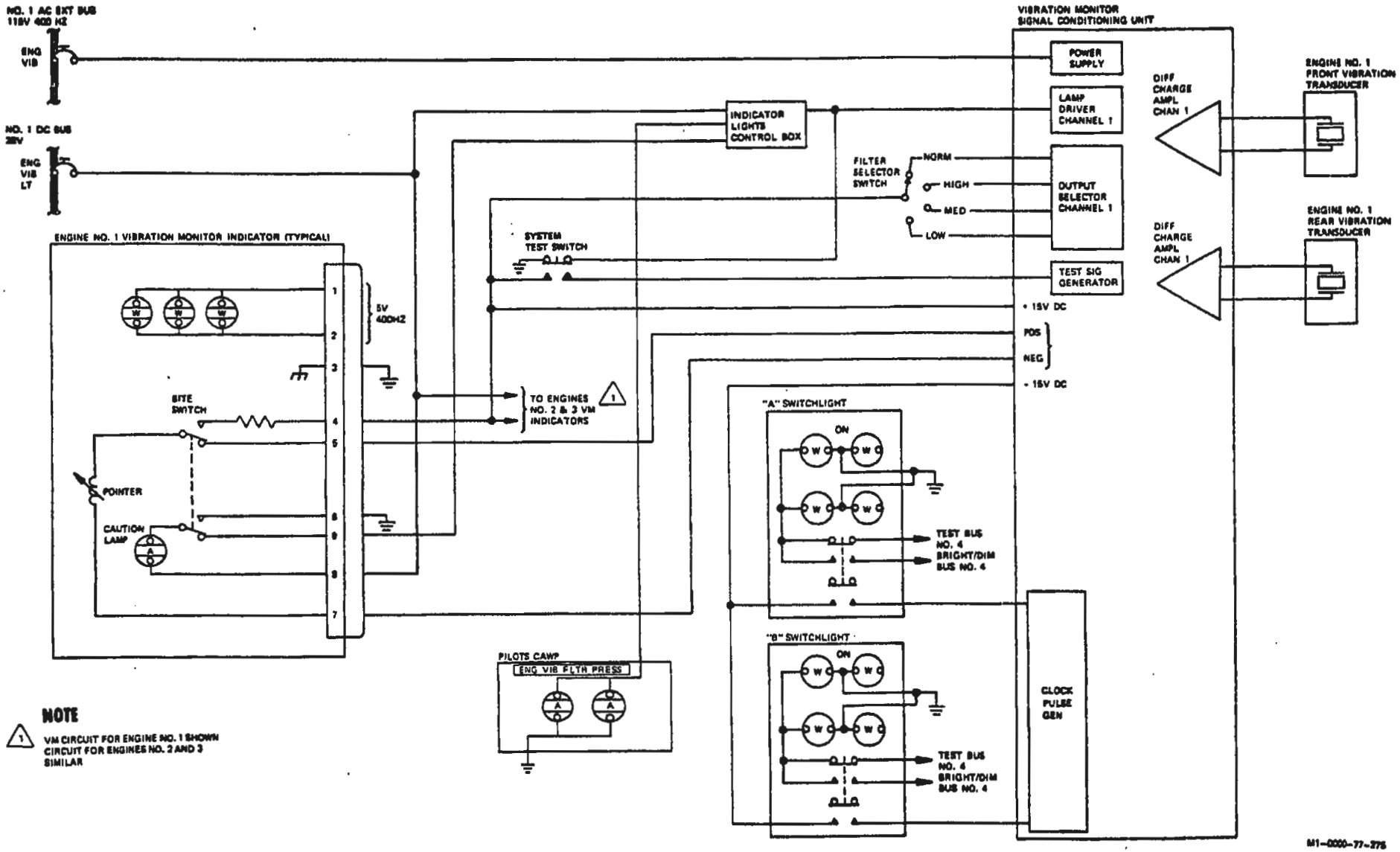
On aircraft 001-031 without SB77-038,
R the system is energized when both FAN and TURB switchlights
R are unlatched and both FAN and TURB switchlights are off.
R With both FAN and TURB switchlights unlatched, the system is reading a rectified signal from the two pickups, alternating between fan and turbine pickup every half second. By selecting one of the switches ON, the input from the other pickup is removed so that only the pickup selected is being read by the indicator.

R NOTE: During normal system operation, only the FAN
R switchlight is latched. If both FAN and TURB switchlights are selected ON, the fan and turbine duplexer gates in the signal conditioner are opened.

On aircraft 001-031 with SB77-038 and 032-999,
R the system is energized when both "A" and "B" switchlights
R are unlatched and both "A" and "B" switchlights are off.
R With both "A" and "B" switchlights unlatched, the system is reading a rectified signal from the two pickups, alternating between "A" and "B" pickup every half second. By selecting one of the switches ON, the input from the other pickup is removed so that only the pickup selected is being read by the indicator.

R NOTE: During normal system operation, only the "A"
R switchlight is latched. If both "A" and "B" switchlights are selected ON, the "A" and "B" duplexer gates in the signal conditioner are opened.

This results in an inaccurate summation of signals to the indicator. It is recommended that the system be operated with only one switch latched for greatest accuracy. If isolation of the pickups shows that one



R Vibration Monitor Simplified Schematic
R Figure 4

is defective, the system can still be used by switching the good pickup into the system, remembering that the inputs from all three engines are controlled by these switches.

By using the system test button on the panel in conjuction with the pickup selector switches and the frequency selector, the indicator, warning lights, signal conditioner, and wiring between these units can be tested at the flight station. The pickups and wiring from them to the signal conditioner are not tested.

The test (BITE) actuator on the indicator checks the indicator by causing it to read approximately 4.0 units and operates the amber warning lights.

3. Vibration Indicator Transducer

A. Description and Operation

The transducer (Ref. Fig. 1), located in zones 412, 422 and 432, is of the piezo-electric accelerometer type and contains no moving parts.

The transducer basically comprises a case containing a crystal stack and tungsten mass, and incorporating an electrical connector. The stack, surmounted by the tungsten mass, consists of eight crystal rings with interconnected electrodes between six of the rings.

The crystal stack may be regarded as a very stiff spring axially loaded by means of a heavy mass, with each ring developing an electrical charge across its face that is proportional to the mechanical stress in the plane normal to the crystal face.

During engine operation, the mounting surface of the transducer is caused to vibrate and the force which the tungsten mass exerts through the crystal stack is proportional to its acceleration of vibration. Consequently, the electric charge output of the crystal stack is proportional to the acceleration of vibration. The electrical charge is transmitted to the signal conditioning unit which processes these electrical signals into a condition suitable for display at the flight station indicator.

4. VM Indicator

A. Description and Operation

Three engine vibration monitoring (VM) indicators are located on the ENGINE STATUS panel, zone 215. These VM indicators provide analog data which is a function of vibration velocity of each engine (Ref. Fig. 5). The indicators are of the movable-coil type.

Each VM indicator is housed in an integrally lighted No. 2 ATI case. The dial plate is black with white markings. The pointer is painted white. Numerals and divisions appearing on the dial plate represent dimensionless units that are a function of vibration velocity. An amber warning light incorporated in the indicator comes on whenever the engine vibrations exceed a preset level.

A built-in-test-equipment (BITE) actuator, located at the lower left corner, closes a switch to energize self-test circuitry in the indicator. When this switch is actuated, the amber warning light comes on and the pointer will indicate approximately 4.0 units to show a correct operating condition.

An electrical receptacle is located at the rear of the indicator case.

5. VM Signal-Conditioning Unit

A. Description

The VM signal-conditioning unit (Ref. Fig. 6) contains the electronic circuitry necessary to condition the transducer signals for transmission to a VM indicator. The unit consists of:

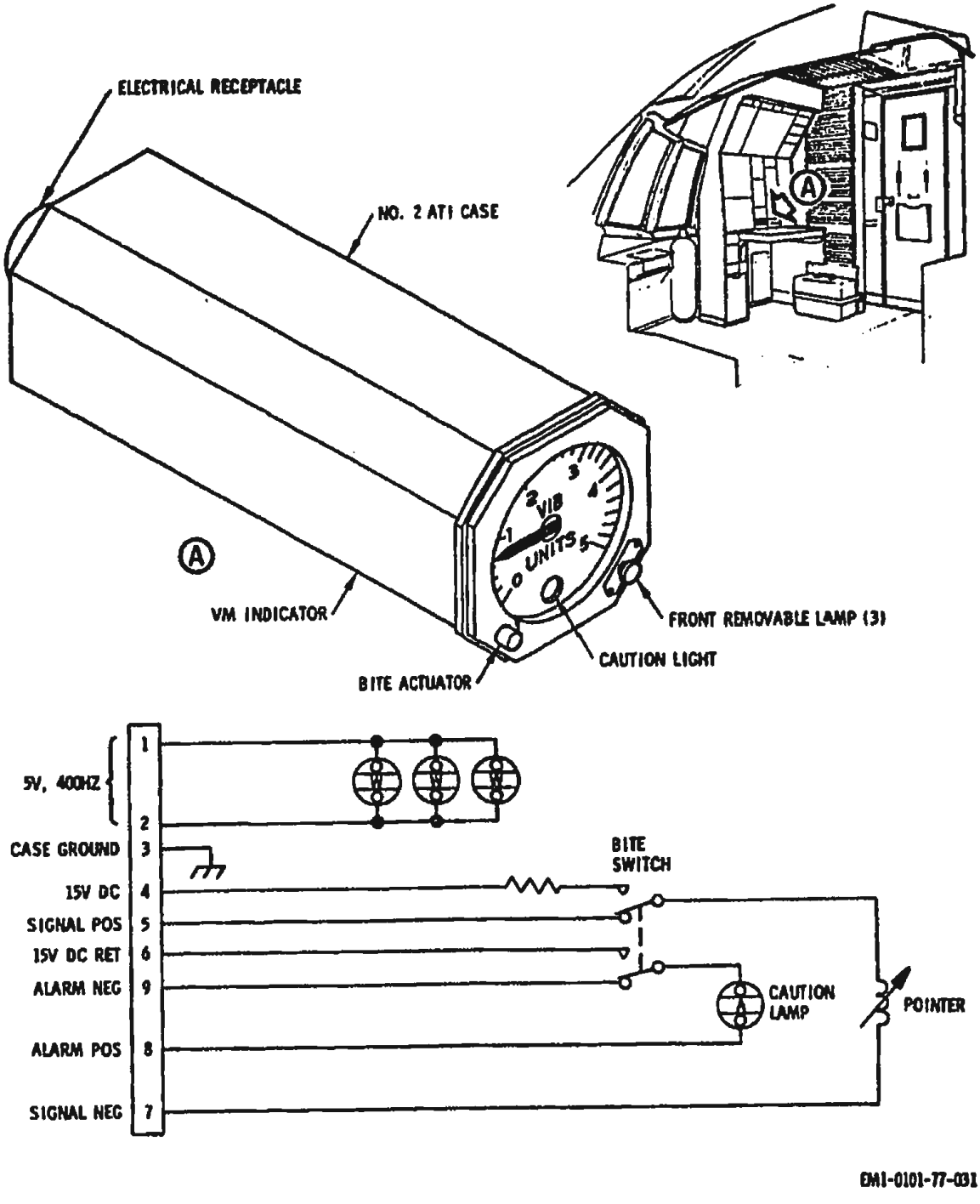
Chassis assembly

Power supply module

Auxiliary module

Three identical channel modules

The modules are removable plug-in units that are secured in the chassis assembly with retaining screws. The auxiliary module and the channel modules are the same size but are keyed through use of different connectors to prevent installation of modules in incorrect locations.



Vibration Monitor Indicator
Figure 5

The signal-conditioning unit is housed in a standard 1/4 ATR short case.

B. Operation

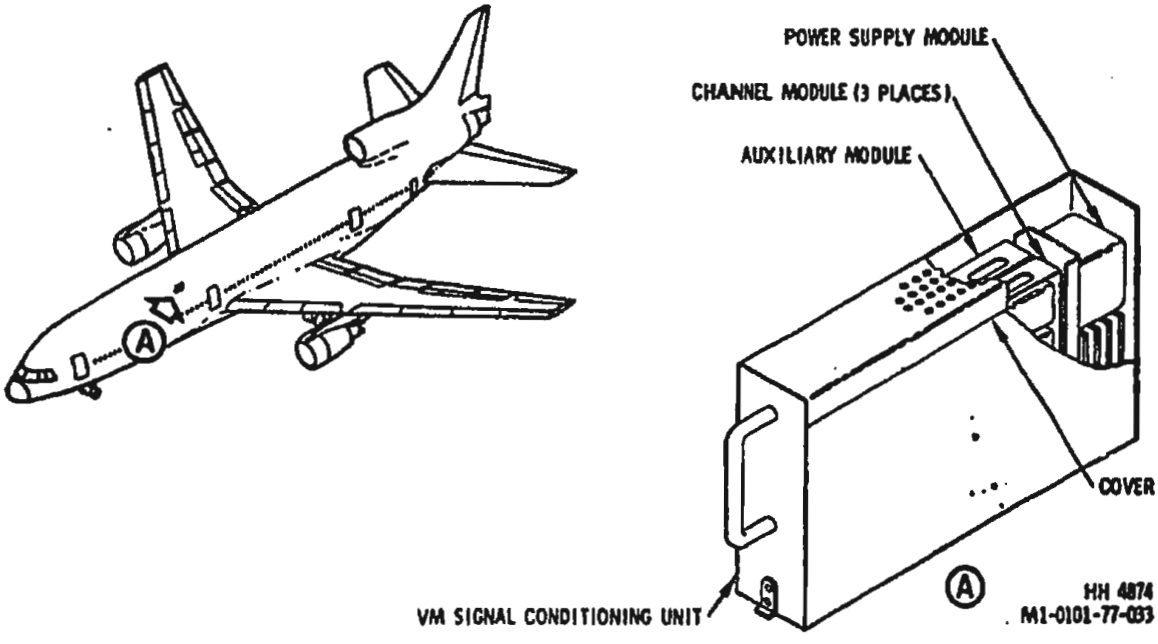
The signal conditioner processes electrical signals from the transducers for display at the indicators. The signal conditioner operates on 115V, 400-Hz power.

On aircraft 001-031 without SB77-038, each engine channel module functions (Ref. Fig. 7) as a double channel, alternately monitoring outputs of front and rear transducers on each engine.

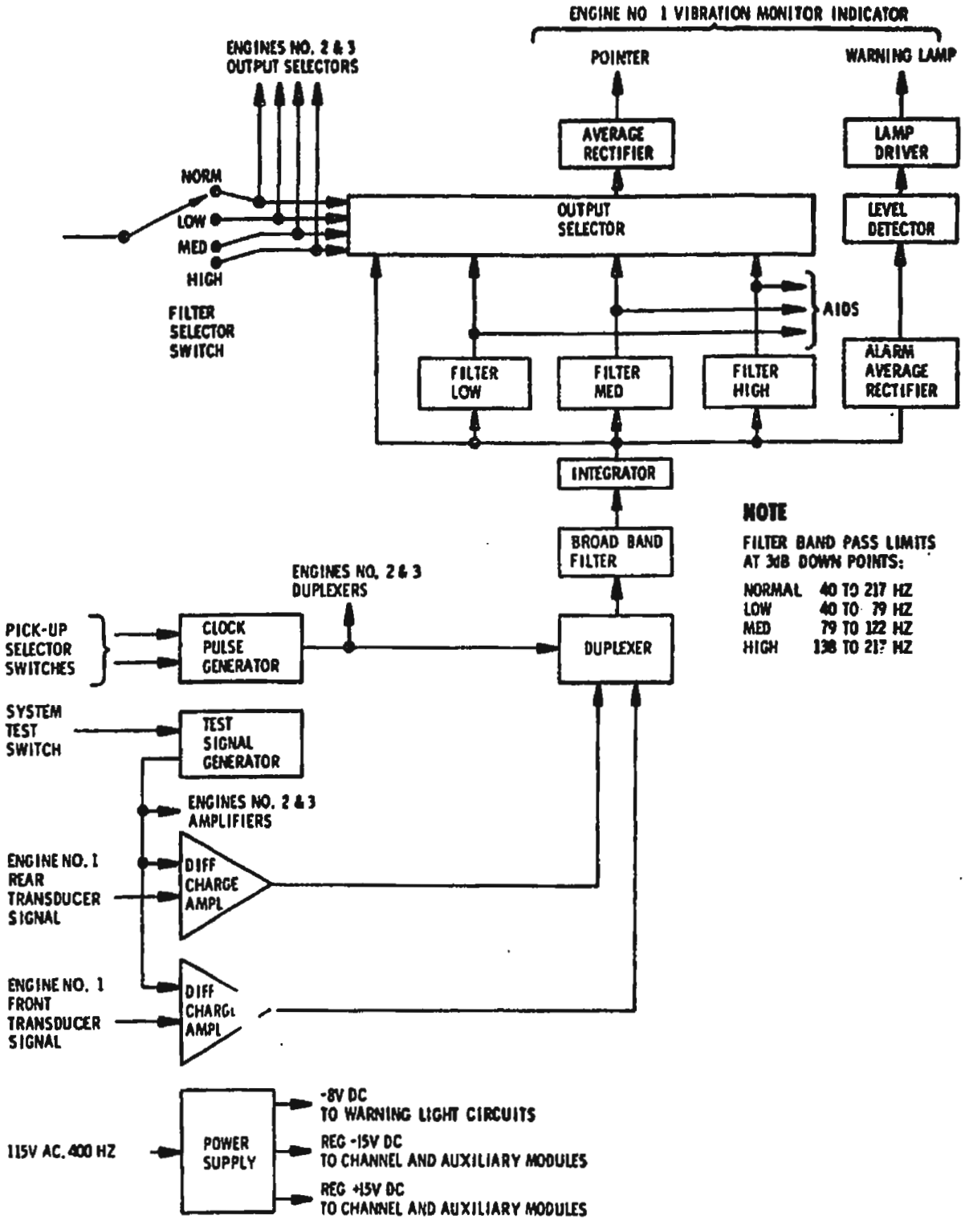
On aircraft 001-031 with SB77-038 and 032-999, each engine channel module functions (Ref. Fig. 7) as a double channel, alternately monitoring outputs of corresponding "A" and "B" transducers on each enigne.

The signal conditioner also provides an alarm signal to the applicable VM indicator when vibration detected from any engine exceeds a preset level.

Transducers sense vibration at their mounting points and generate electric charge signals that are proportional to the acceleration value of the vibration. The charge signals



Signal Conditioning Unit
Figure 6



Signal-Conditioning Unit Block Diagram
Figure 7

from each transducer are applied to the input of individual differential-charge amplifiers which convert charge signals to voltage signals for further processing. The duplexer, which is controlled by a clock pulse generator, alternately connects the charge amplifier outputs to the input of the broadband filter.

On aircraft 001-031 without SB77-038, the clock pulse may be stopped by the FAN or TURB PICKUP SELECTION switchlights located on the Flight Engineer/Second Officers ENGINE STATUS panel, zone 215, to stop duplexing in either the front or rear position. Depressing one of the switchlights provides a display of the vibration data supplied by the selected transducer.

On aircraft 001-031 with SB77-038 and 032-999, the clock pulse may be stopped by the "A" or "B" PICKUP SELECTION switchlights located on the Flight Engineer/Second Officers ENGINE STATUS panel, zone 215, to stop duplexing in either the corresponding "A" or "B" position. Depressing one of the switchlights provides a display of the vibration data supplied by the selected transducer.

A broadband filter limits the signal frequency band to the range of interest. The signal is then integrated to convert the vibration acceleration signal to a vibration velocity signal.

The integrated signal is passed to the input of the alarm rectifier, to the inputs of the narrow-band filters (high, medium, and low), and to an input terminal of the output selector. The narrow-band filters divide the frequency band of interest into three portions for more detailed vibration analysis. The output signals of these filters and the integrator are passed to the output selector.

The output selector is controlled by the filter selector rotary switch on the ENGINE STATUS panel. The output of the selected filter is connected to the input of the average rectifier through the output selector. The signal is amplified and rectified to drive the dc indicator.

The integrated signal is also amplified and rectified by the alarm average rectifier. The rectifier output is coupled to the input of a level detector which senses the amount of vibration. The level detector provides a signal to turn on the warning light on the VM indicator and the ENG VIB FLTR PRESS light, after a few seconds delay, located on the pilots CAWP when a preset level is exceeded. The switching threshold of the detector is set by a resistor on the channel module.

The self-test circuit provides a means of checking proper operation of the system. When the TEST pushbutton switch is actuated, the test signal generator is energized. The amplitude and frequency output of the generator are preset by the position of the filter selection rotary switch.

VIBRATION MONITOR SYSTEM - FAULT ISOLATION

1. General

The fault isolation diagrams in this section can be used for fault isolation any time a fault is reported or suspected. Before fault isolation is started, the PREREQUISITES listed on the diagram must be fulfilled.

If the flight crew reports a trouble using a FIRM Fault Code number, the number can be found in the FIRM Fault Code Cross Reference Table in the Chapter 77 INDEX.

The FIRM Fault Code Cross Reference Table includes the flight report (fault symptoms) and the exact Section, Figure, Sheet, and Block number where fault isolation should begin. (Refer to the L-1011 Maintenance Manual Introduction for a more detailed explanation on the use of fault isolation diagrams.)

If a fault is reported or suspected and no FIRM Fault Code is available, the function or fault indication can be found in the table below. When a diagram is selected in this manner fault isolation is started at Block 1.

2. Fault Isolation/Identification

On aircraft 001-031 without SB77-038, significant vibrations on the RB211 can be detected on either "Fan" or "Turb" AVM transducer irrespective of the source of the vibration. Any genuine engine vibration problem will therefore produce a high indication on both "Fan" and "Turb" transducer selections. If a high indication appears on only one transducer selection, the indication can be regarded as a false one.

On aircraft 001-031 WITH SB77-038 AND 032-999, significant vibrations on the RB211 can be detected on either "A" or "B" AVM transducer irrespective of the source of the vibration. Any genuine engine vibration problem will therefore produce a high indication on both "A" or "B" transducer selections. If a high indication appears on only one transducer selection, the indication can be regarded as a false one.

Table 101 is a list of all fault isolation data in this section of the manual.

Vibration Monitor System Fault Isolation
Table 101

FIGURE	TITLE
101	Component Locator Index
102	Component Locator
103	Vibration Monitor System Fault Isolation
SCHEM 1	Vibration Monitor Electrical Schematic

C 3. Troubleshooting Inflight Shutdown for High AVM, Oil Filter
C Differential Pressure Warning Light On and Low Oil Pressure

CR NOTE: The following contains complete current maintenance
C instructions for handling inflight shutdown for AVM, oil
C filter differential pressure lights and confirmed low oil
C pressure.

C A. RB211 fan shaft location bearing failures have resulted in a
C FAA Airworthiness Directive being issued on the subject.
C This has caused changes to inflight operational procedure
C and results in more restrictive dispatch requirements with
C respect to AVM and oil filter pressure lights.
C Additionally, this has imposed certain related maintenance
C requirements whenever flight crews report inflight shutdown
C for any of the following abnormal indications:

C - High AVM

C - Oil Filter Pressure Warning Light On

C - Oil Pressure Low Warning Light On and Confirmed by Gauge
C Reading

C B. When one of these conditions has resulted in an inflight
C shutdown, the following maintenance action is required
C before further flight:

C (1) High AVM

C (a) Remove and inspect all magnetic chip detectors.

C (b) Remove and inspect pressure and scavenge filters.

C (c) Visually check inlet and exhaust area.

C (d) Perform AVM test 10; advise MCIMD of results.

CR (e) If high AVM confirmed on both A and B channels, borescope IP compressor rotor stage 7, HP compressor stage 6 and HP turbine blade surface within 25 flight hours.

CR NOTE: If high AVM not confirmed, problem may be considered false and borescope deleted. Notify MCIMD if borescope check is deferred or deleted.

CR (f) Make corrections to AVM or placard the inoperative channel.

CR (2) Oil Filter Pressure Warning Light

CR CAUTION: VISUAL INSPECTION OF SCREENS IS NOT SUFFICIENT TO DETECT CLOGGED FILTERS.

CR (a) Remove and inspect all magnetic chip detectors.

CR (b) Remove, inspect, and replace scavenge filter, TWA Stk. Nbr. 260-0055.

CR NOTE: May be cleaned if new screen not available.

CR (c) Remove, inspect, and replace pressure filter, TWA Stk. Nbr. 60-5721.

CR NOTE: This is a disposable type and must be replaced.

CR (d) Determine cause and make corrections.

CR (3) Oil Pressure Low Warning Light On and Confirmed by Gauge Reading

CR (a) Remove and inspect all magnetic chip detectors.

CR (b) Remove, inspect, and replace scavenge filter, TWA Stk. Nbr. 260-0055.

CR NOTE: May be cleaned if new screen not available.

CR (c) Remove, inspect, and replace pressure filter, TWA Stk. Nbr. 60-5721.

CR NOTE: This is disposable type and must be replaced.

CR (d) Determine cause and make corrections.

CR C. Refer to procedures and limits contained in this MSL.
CR Advise MCIMD of problem immediately and document all work
CR accomplished.

CR 4. High AVM Corrections

CR A. Magnetic Chip Detectors (MCD) - Inspect/Check

CR (1) Inspection of chip detectors can give an early
CR indication of the commencement of internal failure and
CR must be carefully analyzed. When one of the above
CR conditions are experienced, all 6 Magnetic Chip
CR Detectors are to be removed and analyzed. They must be
CR accurately identified such as master, internal wheel
CR case, LP/IP front bearing, LP turbine bearing, HP/IP
CR turbine bearing, or high speed external gearbox. This
CR is important as mixing MCD's and using other names
CR leads to confusion and could result in an unnecessary
CR engine removal.

CR (2) The most critical MCD is the internal wheel case. This
CR MCD has been removed from the high speed gear box to a
CR port on the oil return line. This MCD with the master
CR scavenge MCD are accessible through the oil service
CR door. Careful examination of both MCD's is extremely
CR important.

CR (3) Inspect each chip detector magnetic plug for any metal
CR particles which may have accumulated.

CR NOTE: If during analysis the metal particles found on
CR any detector are considered to be indicative of
CR possible engine or gearbox internal failure,
CR remove and inspect the scavenge and pressure
CR filters for supporting evidence. If local
CR analysis is questionable, contact MCIMD to
CR assist in the decision process. Regardless of
CR analysis, the source of all metal is to be
CR identified. Package the metal, identify where
CR metal was found and send to MCIEE as quickly as
CR possible.

CR B. Magnetic Chip Detector Particle Analysis and Assessment (use
CR X5 Magnification)

CR (1) Internal Wheel Case Magnetic Chip Detector

CR (a) Any evidence of metal contamination, if associated
CR with inflight shutdown for engine vibration or low
CR oil pressure indications or oil filter light "ON",
CR contact MCIMD to assist in evaluation.

CR NOTE: If not associated with above and found during the routine MCD check, use the following criteria.

CR (b) Any metal identified as Swarf, Fines, Flakes, or Chips is important. Any fine hair-like metal, which when pressed between fingers is lost in a black smudge, is not important. If the material when pressed between fingers resembles silver paint, it is important; contact MCIMD. If three or more small particles (pencil lead dot size) wipe MCD clean and run engine for 15 minutes at 1.35 EPR and recheck MCD. If more metal is found, remove and check scavenge and pressure screens for contamination. Contact MCIEE to assist with evaluation before further flight. Any metal identified as flakes is extremely important. These are usually roughly circular pieces of thin, flat metal, sometimes with radial splits. One flake is significant enough to require removal and checking of the scavenge and pressure screen.

CR NOTE: Refer Temporary Revision (Appendix 1) in Maintenance Manual 72-01-00, Page 601, for additional information to assist in evaluating master and location bearing magnetic chip detectors.

CR (2) Master Chip Detector - Magnetic Chip Detector

CR NOTE: The following criteria is applicable anytime metal is found on the internal wheel case and master chip detector. Use the previous maintenance action for internal wheel case chip detector outlined in this MSL. If no metal is found on the internal wheel case magnetic chip detector, the limits and analysis found in inspection and check Maintenance Manual 72-01-00 are applicable.

CR (a) Accumulation of fine particles covering more than 1/3 circumference of magnet edge.

CR (b) Over three circular or rectangular flakes up to approximately 1/16 inch.

CR (3) LP/IP, front bearing, LP turbine bearing, HP/IP turbine bearing, high speed external gearbox chip detectors.

CR (a) Analysis and assessment of these chip detectors has not changed. Refer to Inspection and Check Maintenance Manual 72-01-00.

CR C. Fine Scavenge and Pressure Filter Inspection/Check. Refer
CR Inspection and Check Maintenance Manual 72-01-00. Remove
CR fine scavenge and pressure oil filter elements insuring that
CR the residual oil and any debris in the filter housings are
CR drained and collected in a clean container.

CR NOTE: Both scavenge and pressure filters are to be replaced
CR when associated with inflight shutdown. If not
CR available, scavenge may be cleaned. Pressure screen
CR is a disposable type and must be replaced. Scavenge
CR screen, TWA Stk. Nbr. 260-0055; Pressure screen TWA
CR Stk. Nbr. 60-5721.

CR (1) Scavenge filter disassembly for cleaning. Remove the
CR funnels taking care to catch any residual debris
CR trapped between the element and the funnels.

CR (2) Pressure oil filter disassembly for cleaning. All
CR filters are of a metal pleated type and are disposable.
CR It will be necessary to tap the element onto a clean
CR surface after the filter has been dried to free the
CR debris from between the folds. Visually inspect the
CR element opening up the folds by hand to ensure that all
CR debris is removed. If there is question as to
CR contamination, place filter in strong vise and pry or
CR knock off collar ends of filter. The removed pleats
CR can then be more readily spread out and examined.

CR (3) Wash the filters with a clean degreasing fluid such as
CR MEK, trichlorethylene, solvent or clean kerosene.
CR Strain the residue together with the oil drained from
CR each filter housing through filter paper in funnel to
CR collect any particulate matter. Gauze, paper shop
CR towel or finer mesh than the filter element (30 micron)
CR may be used. Refer to L-1011 Maintenance Manual
CR 72-01-00, Removal/Installation.

CR (4) Fine scavenge and pressure oil filter inspection.

CR NOTE: Both scavenge and pressure filters are to be
CR replaced when associated with inflight shutdown.
CR If not available, scavenge filter may be
CR cleaned. Pressure screen is a disposable type
CR and must be replaced. Scavenge screen, TWA Stk.
CR Nbr. 260-0055; Pressure screen, TWA Stk. Nbr.
CR 60-5721.

CR (a) Check the filtered residue from each filter with a
CR strong magnet to detect the presence of ferrous
CR particles. Refer Maintenance Manual 72-01-00
CR Inspection/Check for guidance on acceptable

C standards and in particular paragraphs which
C identify and describe bearing debris.

C (b) Some fine ferrous particles are usually apparent
C even in a serviceable engine. As a guide,
C experience indicates that the amount should not
C exceed that which would thinly cover 0.5
C inch-sided square (i.e. .25 square inch area).

C (c) If large amounts of ferrous particles are evident
C but there is still doubt whether this is evidence
C of bearing distress, replace the fine scavenge and
C pressure filters; clean the magnetic chip
C detectors and run engine at 1.35 EPR for 15
C minutes. Remove and reinspect all MCD's,
C pressure, and scavenge screens using above
C procedure.

C (d) If any of these inspections reveal any excessive
C amount of fine ferrous particles or any evidence
C of bearing material, notify MCIEE before further
C flight.

CR NOTE: Any contamination found should be sent via
CR dispatch to MCIEE for review using Form
CR ENG437 Envelope, TWA Stk. Nbr 64-0236.

C (e) If debris other than ferrous metal is found in the
C oil filter (carbon for example), accomplish the
C normal troubleshooting procedure per M11-79-03.

C D. Visual Inspection

C (1) Visually inspect engine inlet LP compressor and exhaust
C area for evidence of FOD and/or debris.

C (2) Any damage or debris will require further investigation
C and/or complete borescope, refer Maintenance Manual
C 72-00-00 Inspection/Check.

C E. Borescope Procedure (When Required)

C (1) Perform borescope of IP compressor or stage 7, HP
C compressor stage 6 HP turbine blade surface.

C (2) Any damage found will require further evaluation and/or
C complete borescope, refer Maintenance Manual 72-00-00
C Inspection/Check.

C F. AVM Integrity Check

C (1) Perform test 10 vibration survey, refer M11-71-06.
C Notify MCIMD of readings prior to dispatch of aircraft.

C G. AVM Corrections

C (1) After accomplishment of all steps if no problem is
C found, malfunction should be considered false
C indications.

C (2) AVM restrictions require one AVM channel be operative
C on all engines and that the operative channels are
C indicated continuously on the Flight Engineer's panel,
C refer MEL limitations.

C (3) For procedure to ensure continuous flight deck
C indication when the inoperative channels on different
C engines are dissimilar, refer Maintenance Manual
C 77-31-00, Page 201.

C (4) Corrections to false AVM problems which have resulted
C in an inflight shutdown must have MCIMD concurrence
C before further flight.

C 5. Oil Filter Differential Pressure Warning Light On

C A. Remove and Inspect all Magnetic Chip Detectors

C (1) Refer to Section 4.A., Magnetic Chip
CR Detectors-Inspection/Check, through 4.B.(3)(a) and
C comply with its contents.

C B. Remove and Inspect Pressure and Scavenge Filters

C NOTE: Both scavenge and pressure filters are to be replaced
C when associated with inflight shutdown. If not
C available, scavenge filter may be cleaned and reused.
C Pressure screen is a disposable type and must be
C replaced. Scavenge screen, TWA Stk. Nbr. 260-0055;
C Pressure screen, TWA Stk. Nbr. 60-5721.

C (1) Refer to Section 4.C., Fine Scavenge and Pressure
CR Filter Inspection/Check, through 4.C.(4)(a) and comply
C with its contents.

C C. Determine cause of oil filter pressure warning light on and
C make corrections prior to dispatch.

C NOTE: Visual inspection of scavenge screen is not adequate
C to detect clogged condition.

C (1) MEL prohibits dispatch of aircraft with oil filter pressure warning light inoperative, refer Minimum Equipment List.

C (2) Consult Maintenance Manual Fault Isolation 79-00-00 for troubleshooting procedures.

C 6. Oil Pressure Low Warning Light and Confirmed by Gauge Reading

C A. Remove and inspect all magnetic chip detectors.

C (1) Refer to Section 4.B.(3)(a) of this MSL and comply with its contents.

C B. Refer to Section 4.C., Fine Scavenge and Pressure Filter Inspection/Check, through 4.C.(4)(e) of this MSL and comply with its contents.

C C. Determine cause of oil pressure low warning light malfunction and make corrections prior to dispatch.

C (1) MEL prohibits dispatch of aircraft with low oil pressure warning light inoperative, refer Minimum Equipment List.

C (2) Consult Maintenance Manual Fault Isolation 79-00-00 for troubleshooting procedure.

C 7. Light vibration with negligible increase in AVM and no indication of engine failure.

C A. Squawks associated with No. 2 engine position may range from thrust lever vibration, rudder pedal vibration, to excessive noise in rear of aircraft.

C (1) Check engine inlet for bent or damaged fan blades.

C (2) Check exhaust area for nicked or damaged turbine blades.

C (3) Check all magnetic chip detectors. If any metal is found, remove and check pressure and scavenge screens and advise MCIMD of findings.

C (4) Contact MCIMD to set up borescope checks M11-72-01; -03; -04 on next overnight layover where qualified personnel are available.

C (5) After first borescope MCIEE will set up any additional check required.

C (6) Be sensitive to airframe controls, bleed system,
C hydraulics and fuel pump harmonic effect.

C (7) Advise MCIMD and MCIEE of problem for watch and to set
C up additional checks if necessary.

COMPONENT	QTY	AREA/ACCESS	REFERENCE
SIGNAL CONDITIONER	1	MESC/192K AND 137AZ	77-31-03
VIBRATION TRANSDUCER:			
IP COMPRESSOR CASE	3	IP COMPRESSOR SECTION/RH UPPER FAIRING	
IP TURBINE CASE	3	IP TURBINE SECTION/LOWER FAIRING	77-31-01
VIBRATION MONITOR (VM) INDICATOR	3	FLIGHT STATION/ENGINE STATUS PANEL	77-31-02

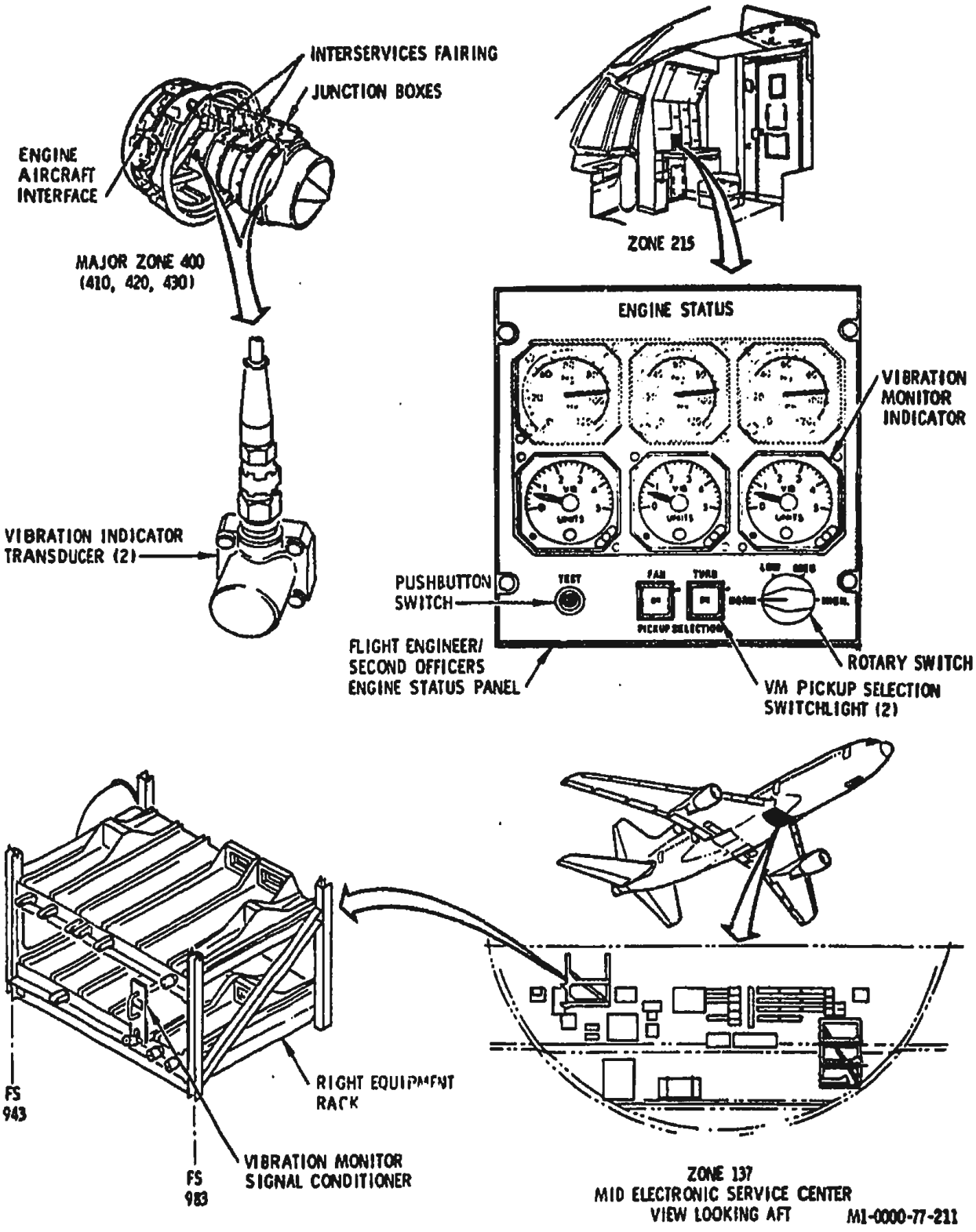
M1-0000-77-206

Component Location Index
Figure 101

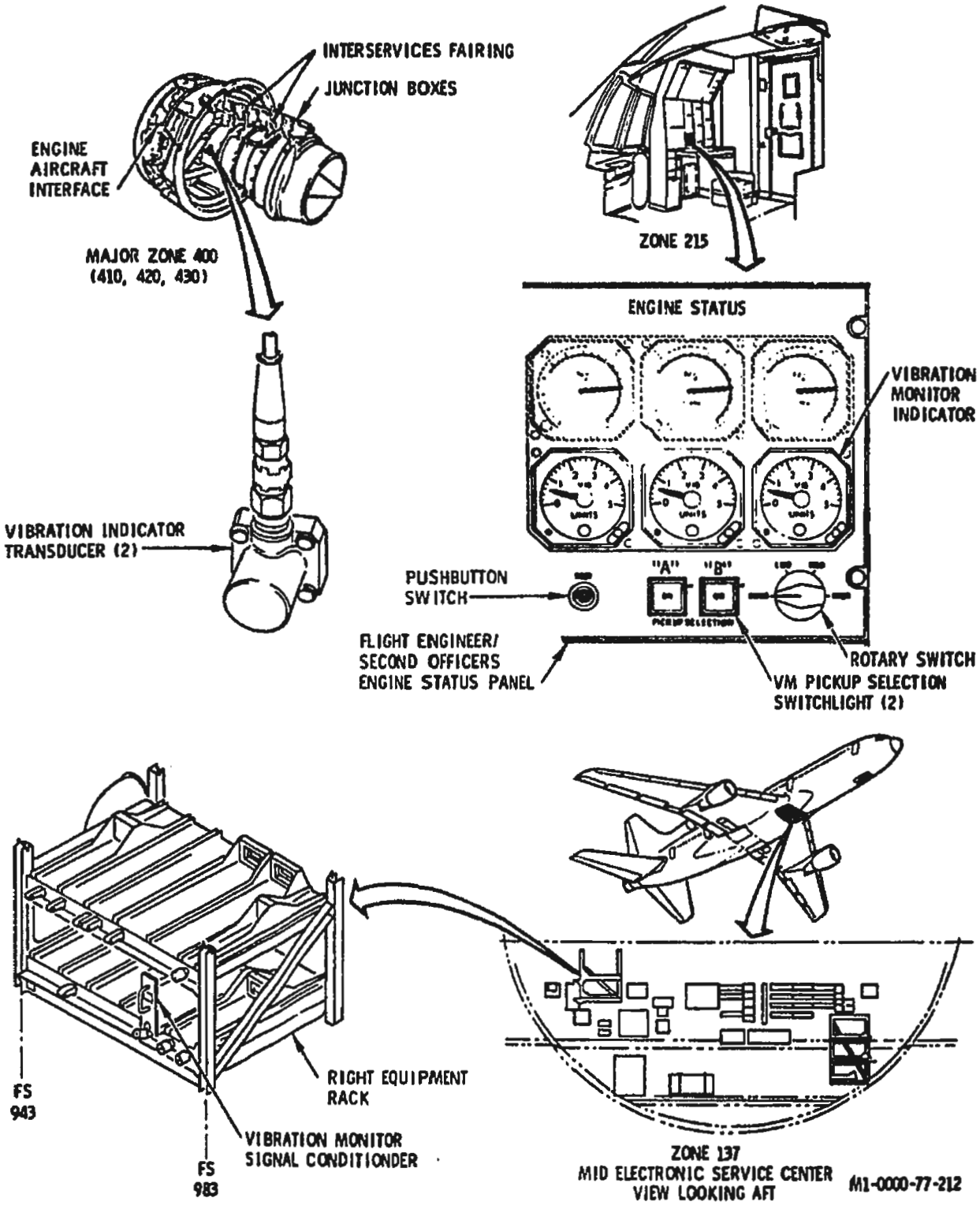
COMPONENT	QTY	AREA/ACCESS	REFERENCE
SIGNAL CONDITIONER	1	MESC/192K AND 137AZ	77-31-03
VIBRATION TRANSDUCER	6	IP COMPRESSOR SECTION/RH UPPER FAIRING	77-31-01
VIBRATION MONITOR (VM) INDICATOR	3	FLIGHT STATION/ENGINE STATUS PANEL	77-31-02

M1-0000-77-208

Component Location Index
Figure 101

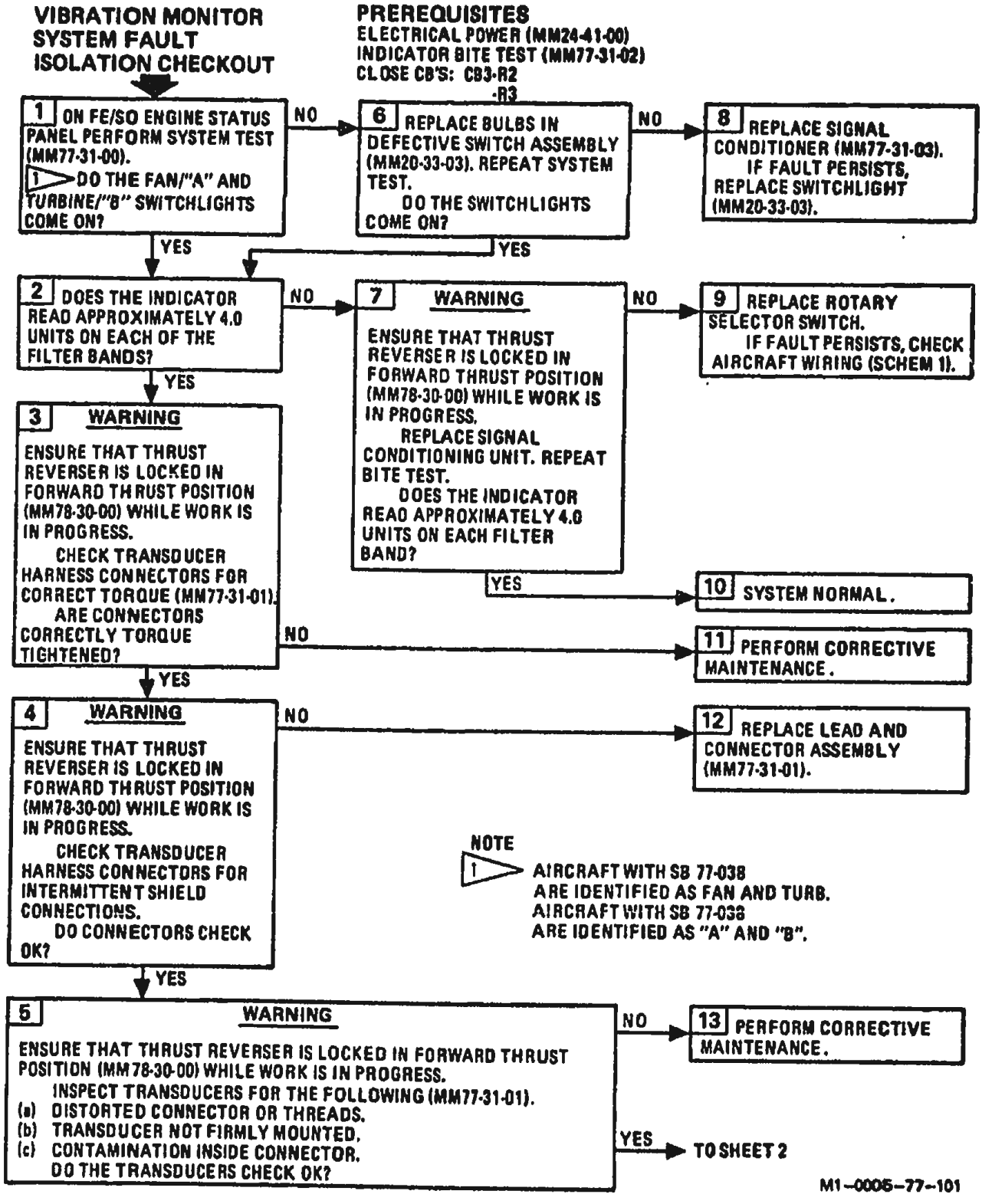


Component Locator
Figure 102



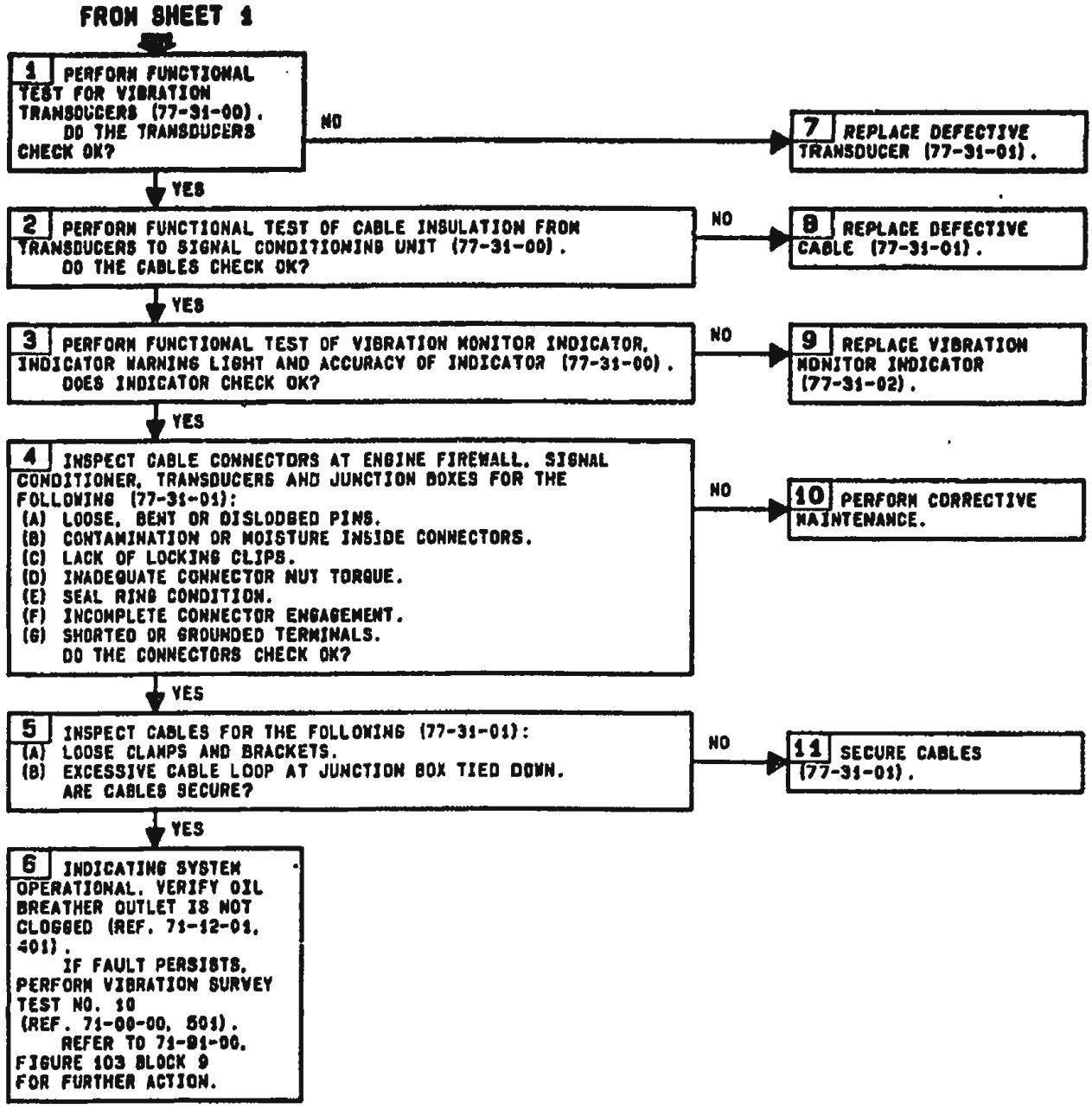
Component Locator
Figure 102

R EFFECTIVITY: 001-031 WITH SB77-038 AND 032-999
R
001B


VIBRATION MONITOR SYSTEM FAULT ISOLATION CHECKOUT
PREREQUISITES
ELECTRICAL POWER (MM24-41-00)
INDICATOR BITE TEST (MM77-31-02)
CLOSE CB'S: C83-R2
-R3
1 ON FE/SO ENGINE STATUS PANEL PERFORM SYSTEM TEST (MM77-31-00).
1 DO THE FAN/"A" AND TURBINE/"B" SWITCHLIGHTS COME ON?
NO
6 REPLACE BULBS IN DEFECTIVE SWITCH ASSEMBLY (MM20-33-03). REPEAT SYSTEM TEST.
DO THE SWITCHLIGHTS COME ON?
NO
8 REPLACE SIGNAL CONDITIONER (MM77-31-03).
IF FAULT PERSISTS, REPLACE SWITCHLIGHT (MM20-33-03).
YES
YES
2 DOES THE INDICATOR READ APPROXIMATELY 4.0 UNITS ON EACH OF THE FILTER BANDS?
NO
7 WARNING
ENSURE THAT THRUST REVERSER IS LOCKED IN FORWARD THRUST POSITION (MM78-30-00) WHILE WORK IS IN PROGRESS.
REPLACE SIGNAL CONDITIONING UNIT. REPEAT BITE TEST.
DOES THE INDICATOR READ APPROXIMATELY 4.0 UNITS ON EACH FILTER BAND?
NO
9 REPLACE ROTARY SELECTOR SWITCH.
IF FAULT PERSISTS, CHECK AIRCRAFT WIRING (SCHEM 1).
YES
YES
10 SYSTEM NORMAL.
3 WARNING
ENSURE THAT THRUST REVERSER IS LOCKED IN FORWARD THRUST POSITION (MM78-30-00) WHILE WORK IS IN PROGRESS.
CHECK TRANSDUCER HARNESS CONNECTORS FOR CORRECT TORQUE (MM77-31-01).
ARE CONNECTORS CORRECTLY TORQUE TIGHTENED?
NO
11 PERFORM CORRECTIVE MAINTENANCE.
YES
4 WARNING
ENSURE THAT THRUST REVERSER IS LOCKED IN FORWARD THRUST POSITION (MM78-30-00) WHILE WORK IS IN PROGRESS.
CHECK TRANSDUCER HARNESS CONNECTORS FOR INTERMITTENT SHIELD CONNECTIONS.
DO CONNECTORS CHECK OK?
NO
12 REPLACE LEAD AND CONNECTOR ASSEMBLY (MM77-31-01).
NOTE
1 AIRCRAFT WITH SB 77-038 ARE IDENTIFIED AS FAN AND TURB.
AIRCRAFT WITH SB 77-038 ARE IDENTIFIED AS "A" AND "B".
YES
5 WARNING
ENSURE THAT THRUST REVERSER IS LOCKED IN FORWARD THRUST POSITION (MM78-30-00) WHILE WORK IS IN PROGRESS.
INSPECT TRANSDUCERS FOR THE FOLLOWING (MM77-31-01).
(a) DISTORTED CONNECTOR OR THREADS.
(b) TRANSDUCER NOT FIRMLY MOUNTED.
(c) CONTAMINATION INSIDE CONNECTOR.
DO THE TRANSDUCERS CHECK OK?
NO
13 PERFORM CORRECTIVE MAINTENANCE.
YES
TO SHEET 2
M1-0005-77-101

Vibration Monitor System Fault Isolation
Figure 103 (Sheet 1)

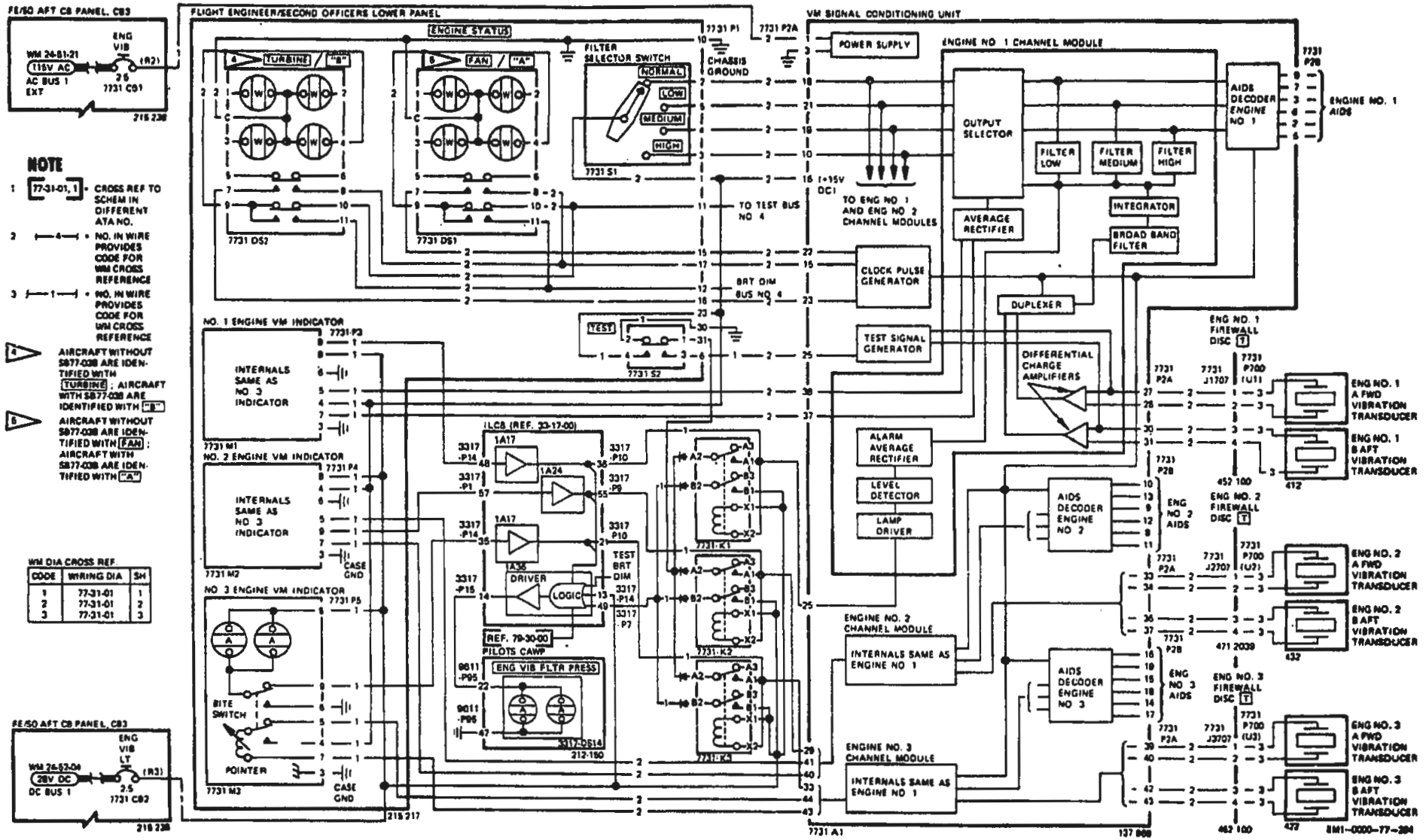
PREREQUISITES
(SEE SHEET 1)


FROM SHEET 1
1 PERFORM FUNCTIONAL TEST FOR VIBRATION TRANSDUCERS (77-31-00). DO THE TRANSDUCERS CHECK OK?
NO
7 REPLACE DEFECTIVE TRANSDUCER (77-31-01).
YES
2 PERFORM FUNCTIONAL TEST OF CABLE INSULATION FROM TRANSDUCERS TO SIGNAL CONDITIONING UNIT (77-31-00). DO THE CABLES CHECK OK?
NO
8 REPLACE DEFECTIVE CABLE (77-31-01).
YES
3 PERFORM FUNCTIONAL TEST OF VIBRATION MONITOR INDICATOR, INDICATOR WARNING LIGHT AND ACCURACY OF INDICATOR (77-31-00). DOES INDICATOR CHECK OK?
NO
9 REPLACE VIBRATION MONITOR INDICATOR (77-31-02).
YES
4 INSPECT CABLE CONNECTORS AT ENGINE FIREWALL, SIGNAL CONDITIONER, TRANSDUCERS AND JUNCTION BOXES FOR THE FOLLOWING (77-31-01):
(A) LOOSE, BENT OR DISLODGED PINS.
(B) CONTAMINATION OR MOISTURE INSIDE CONNECTORS.
(C) LACK OF LOCKING CLIPS.
(D) INADEQUATE CONNECTOR NUT TORQUE.
(E) SEAL RING CONDITION.
(F) INCOMPLETE CONNECTOR ENGAGEMENT.
(G) SHORTED OR GROUNDED TERMINALS.
DO THE CONNECTORS CHECK OK?
NO
10 PERFORM CORRECTIVE MAINTENANCE.
YES
5 INSPECT CABLES FOR THE FOLLOWING (77-31-01):
(A) LOOSE CLAMPS AND BRACKETS.
(B) EXCESSIVE CABLE LOOP AT JUNCTION BOX TIED DOWN.
ARE CABLES SECURE?
NO
11 SECURE CABLES (77-31-01).
YES
6 INDICATING SYSTEM OPERATIONAL. VERIFY OIL BREATHER OUTLET IS NOT CLOGGED (REF. 71-12-01, 401).
IF FAULT PERSISTS, PERFORM VIBRATION SURVEY TEST NO. 10 (REF. 71-00-00, 501).
REFER TO 71-91-00, FIGURE 103 BLOCK 9 FOR FURTHER ACTION.

M1-0001-77-403

C Vibration Monitor system Fault Isolation
C Figure 103 (Sheet 2)

R EFFECTIVITY: ALL
R
001B


FE/SO AFT CB PANEL, CB3
FLIGHT ENGINEER/SECOND OFFICERS LOWER PANEL
VM SIGNAL CONDITIONING UNIT
ENGINE STATUS
FILTER SELECTOR SWITCH
NORMAL
LOW
MEDIUM
HIGH
CHASSIS GROUND
TO TEST BUS NO 4
BRT DIM BUS NO 4
TO ENG NO 1 AND ENG NO 2 CHANNEL MODULES
POWER SUPPLY
ENGINE NO 1 CHANNEL MODULE
OUTPUT SELECTOR
FILTER LOW
FILTER MEDIUM
FILTER HIGH
AIDS DECODER ENGINE NO 1
ENGINE NO. 1 AIDS
AVERAGE RECTIFIER
INTEGRATOR
BROAD BAND FILTER
CLOCK PULSE GENERATOR
DUPLEXER
TEST SIGNAL GENERATOR
DIFFERENTIAL CHARGE AMPLIFIERS
ALARM AVERAGE RECTIFIER
LEVEL DETECTOR
LAMP DRIVER
NO. 1 ENGINE VM INDICATOR
NO. 2 ENGINE VM INDICATOR
NO 3 ENGINE VM INDICATOR
INTERNALS SAME AS NO 3 INDICATOR
BITE SWITCH
POINTER
CASE GND
LCB (REF. 33-17-00)
DRIVER
LOGIC
TEST BRT DIM
REF. 79-30-00
PILOTS CAWP
ENG VIB FLTR PRESS
AIDS DECODER ENGINE NO 2
ENG NO 2 AIDS
ENGINE NO. 2 CHANNEL MODULE
INTERNALS SAME AS ENGINE NO 1
AIDS DECODER ENGINE NO 3
ENG NO 3 AIDS
ENGINE NO. 3 CHANNEL MODULE
ENG NO. 1 FIREWALL DISC
ENG NO. 2 FIREWALL DISC
ENG NO. 3 FIREWALL DISC
ENG NO. 1 A FWD VIBRATION TRANSDUCER
ENG NO. 1 B AFT VIBRATION TRANSDUCER
ENG NO. 2 A FWD VIBRATION TRANSDUCER
ENG NO. 2 B AFT VIBRATION TRANSDUCER
ENG NO. 3 A FWD VIBRATION TRANSDUCER
ENG NO. 3 B AFT VIBRATION TRANSDUCER
NOTE
CROSS REF TO SCHEM IN DIFFERENT ATA NO.
NO. IN WIRE PROVIDES CODE FOR WM CROSS REFERENCE
NO. IN WIRE PROVIDES CODE FOR WM CROSS REFERENCE
AIRCRAFT WITHOUT SB77-038 ARE IDENTIFIED WITH TURBINE ; AIRCRAFT WITH SB77-038 ARE IDENTIFIED WITH "B"
AIRCRAFT WITHOUT SB77-038 ARE IDENTIFIED WITH FAN ; AIRCRAFT WITH SB77-038 ARE IDENTIFIED WITH "A"
WM DIA CROSS REF
CODE
WIRING DIA
SH
1 77-31-01 1
2 77-31-01 2
3 77-31-01 3

Vibration Monitor Electrical Schematic
SCHEM 1

EFFECTIVITY: ALL

001B

C VIBRATION MONITOR (VM) SYSTEM - MAINTENANCE PRACTICES

CR 1. Maintenance Procedures - General

CR This procedure (channel switching) modifies the Airborne
CR Vibration Monitoring (AVM) System wiring to allow
CR interchangeability of channels A (or FAN) and B (or TURBINE).
CR The purpose of this modification is to provide continuous AVM
CR monitoring in the Flight Station. Note that engine vibration
CR sensor selector switchlights on the FE/SO ENGINE STATUS PANEL
CR are designated "A" and "B" on aircraft with Service Bulletin
CR 093-77-038 installed. On airplane without Service Bulletin
CR 093-77-038 installed, the switchlights will be designated "FAN"
CR and "TURBINE".

CR Normal in-flight engine vibration monitoring is required to be
CR by single channel, either Channel A or Channel B. It is
CR recommended that the selected channel be alternated from time to
CR time to assure early detection of dormant failure.

CR In event of failure of the selected AVM channel in flight, the
CR other channel should be selected. No immediate maintenance
CR action is required. In event of in-flight failure of both AVM
CR channels, flight may continue so long as other engine parameters
CR remain normal. Prior to next dispatch, at least one AVM
CR channel, either A or B, must be operable.

CR If it is determined that faults are in the AVM transducers or
CR wiring of two engines, one on Channel A and the other on Channel
CR B, then the following channel switching procedure (same as
CR Service Bulletin 093-77-047) is appropriate to achieve one
CR operable channel. The procedure is also appropriate if, for
CR example, the Channel A fault is in the aircraft wiring and the
CR Channel B fault in an engine. The procedure is not appropriate
CR if faults in both channels are on the airframe side of the
CR engine/airframe interface.

CR Use of the channel switching procedure is an authorized
CR expedient to achieve one operable AVM channel with non-standard
CR wire connections. The fault should be repaired and wiring
CR returned to standard configuration as soon as practical.

CR Engine No. 1 and 3 AVM wiring can be modified two ways. The
CR first procedure installs a short (6-inch) wire harness between
CR the vibration sensor and the firewall disconnect. The second
CR method modifies the firewall disconnect by altering the pin
CR arrangements.

CR Engine No. 2 AVM wiring can be modified three ways. The first
CR method is to install the short (6-inch) wire harness between the

CR vibration sensor and the firewall disconnect (same as Engine No. 1 and 3). The second and third methods are similar to that required for Engines No. 1 and 3 where the pin arrangement is altered, but a choice of disconnects is offered, either the firewall disconnect or a disconnect accessed through a panel adjacent to the L4 passenger door.

CR 2. Referenced Procedures

CR	6-50-00	Access Doors and Removable Panels
CR	24-41-00	External Power/Ground Service System - Maintenance Procedures
CR	71-11-00	Cowling, Engines No. 1 and No. 3 - Servicing
CR	71-12-05	LH and RH Upper Hinged Cowls - Servicing
CR	77-31-00	Vibration Monitor (AVM) System - Adjustment and Test

CR 3. Engine No. 1 or No. 3 - AVM Wiring Modifications

CR A. Procedure No. 1

CR NOTE: This procedure installs a six-inch jumper harness between the sensor ard the engine firewall disconnect. The harness is wired to interchange the "A" and "B" AVM sensor signal flow. This procedure is applicable to Engine No. 2 except access is by opening LH upper hinged cowl 433DL, reference MM 71-12-05.

CR (1) On FE/SO aft circuit breaker panel CB3, open and tag circuit breakers ENG VIB (R2) and ENG VIB LT (R3).

CR (2) Open LH hinged cowl 413A for Engine No. 1 and/or 423A for Engine No. 3.

CR (3) Remove firewall electrical disconnect plug "T" (7731-P700).

CR (4) Connect the six-inch AVM Channel Interchange Harness, reference Figure 201, between the firewall jack 7731-J1707 (Engine 1) or 7731-J3707 (Engine 3) and firewall disconnect plug 7731-P700.

CR (5) Secure the interchange harness and disconnect plug 7731-P700 in a manner that will prevent signal interference in the AVM System.

CR (6) Close and secure the cowl opened in Step (2).

CR (7) Remove tags and close circuit breakers previously
CR opened in Step (1).

CR (8) Apply external ground power.

CR (9) Perform the SYSTEM (BITE) Test, reference MM 77-31-00.

CR (10) Install appropriate placard on FE/SO panel.

CR (11) Make appropriate entry in the airplane log book.

CR B. Procedure No. 2

CR NOTE: This procedure is also applicable to engine No. 2
CR except access is by opening LH upper hinged cowl
CR 433DL, reference MM 71-12-05.

CR (1) On FE/SO aft circuit breaker panel CB3, zone 215, open
CR and tag circuit breakers ENG VIB (R2) and ENG VIB LT
CR (R3).

CR (2) Open LH hinged cowl 413A or 423A for engines No. 1 and
CR 3 (Ref. MM 71-11-00).

CR (3) Disconnect electrical interface plug "T" (7731-P700).

CR (4) If A/FAN is to be selected, exchange faulty A/FAN
CR channel for good B/TURB channel at plug "T" as follows:

CR (a) Remove signal wires from pins 1 and 2, and
CR shielded wire from pin 7 or 10. Temporarily stow
CR wires.

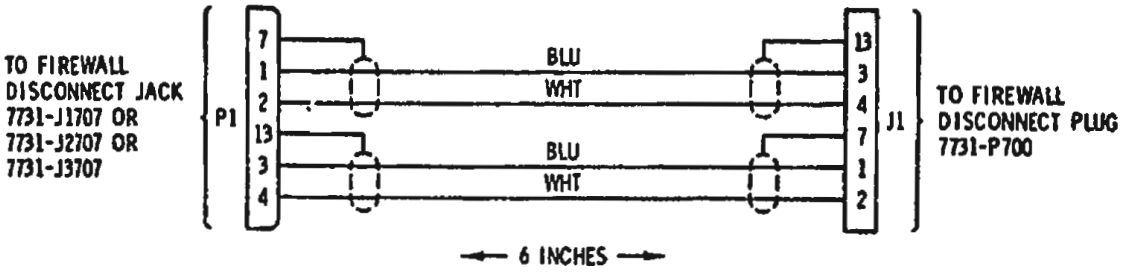
CR (b) Remove signal wires from pins 3 and 4, shielded
CR wire from pin 5 or 13 and install in pins 1, 2,
CR and 7 or 10 respectively.

CR (5) If B/TURB is to be selected, exchange faulty B/TURB
CR channel for good A/FAN channel at plug "T" as follows:

CR (a) Remove signal wires from pins 3 and 4, and
CR shielded wire from pin 5 or 13. Temporarily stow
CR wires.

CR (b) Remove signal wires from pins 1 and 2, shielded
CR wire from pin 7 or 10 and install in pins 3, 4,
CR and 5 or 13 respectively.

CR (6) Reconnect plug "T".



PARTS LIST

PLUG P1 (1 EACH):	PYLE PART NO. FPK-1218-14PTD
VENDOR:	PYLE-NATIONAL CO., DIVISION OF BRAND REX CO. (49367), 1334 N. KOSTNER AVENUE, CHICAGO, ILLINOIS 60651
JACK J1 (1 EACH):	PYLE PART NO. FPK-1718-14STD
VENDOR:	(SAME ADDRESS AS PLUG P1 ABOVE)
WIRE:	RAYCHEM 202-3834-0000 (SPECIFY SOLID BLUE AND SOLID WHITE)
VENDOR:	RAYCHEM CORPORATION (06090), 300 CONSTITUTION DRIVE, MENLO PARK, CALIFORNIA 94025
BACKSHELL (2 EACH):	LS12686R18
VENDOR:	THE DEUTSCH COMPANY (11139) ELECTRONIC COMPONENTS DIVISION, 700 S. HATHAWAY, MUNICIPAL AIRPORT, BANNING, CALIFORNIA 92220

M1-0000-77-313

R Airborne Vibration Monitor (AVM) Channel Interchange Harness
R Figure 201

CR (7) Close cowls opened in Step (2) (Ref. MM 71-11-00).

CR (8) Remove tags and close circuit breakers opened in Step CR (1).

CR (9) On FE/SO lower panel, zone 215, locate ENGINE STATUS CR panel.

CR (10) With A/FAN or B/TURB selected (switch latched in), CR verify light on.

CR (11) Perform system BITE test (Ref. MM 77-31-00).

CR (12) Placard appropriate flight station pickup switchlight CR inoperative and make log book entry to reflect CR modification.

CR 4. Engine No. 2 - AVM Wiring Modifications

CR A. Procedure No. 1

CR (1) For Engine No. 2, perform Procedure No. 1, for Engines CR No. 1 and 3 as outlined in Para. 3. Exceptions to the CR steps in this procedure are:

CR (a) Access to Engine No. 2 firewall electrical CR disconnect plug "T" (7731-P700) is through open LH CR upper hinged cowl 433DL, reference MM 71-12-05.

CR (b) Firewall disconnect jack is designated 7731-J2707 CR for Engine No. 2.

CR B. Procedure No. 2

CR (1) For Engine No. 2, perform Procedure No. 2 as outlined CR for Engine No. 1 and 3 in Para. 3. Exceptions to the CR steps in this procedure are:

CR (a) Access to Engine No. 2 firewall electrical CR disconnect plug "T" (7731-P700) is through open LH CR upper hinged cowl 433DL, reference MM 71-12-05.

CR (b) Firewall disconnect jack is designated 7731-J2707 CR for Engine No. 2.

CR C. Procedure No. 3

CR NOTE: This procedure modifies the AVM wiring by altering CR pin arrangements at a disconnect installed in the CR rear cabin overhead. Utilize Procedure 1 or 2 if it CR is desired to use an engine firewall disconnect.

CR (1) On FE/SO aft circuit breaker panel CB3, zone 215, open
CR and tag circuit breakers ENG VIB (R2) and ENG VIB LT
CR (R3).

CR (2) Open access panel LH273 adjacent to LH aft passenger
CR door to gain access to electrical panel.

CR (3) Disconnect plug 37 (9811-P179).

CR (4) If A/FAN is to be selected, exchange faulty A/FAN
CR channel for good B/TURB channel at plug 37 as follows:

CR (a) Remove signal wires from pins 1 and 2, and
CR shielded wire from pin 3. Temporarily stow wires.

CR (b) Remove signal wires from pins 4 and 5, shielded
CR wire from pin 6 and install pins 1, 2 and 3,
CR respectively.

CR (4) If B/TURB is to be selected, exchange faulty B/TURB
CR channel for good A/FAN channel at plug 37 as follows:

CR (a) Remove signal wires from pins 4 and 5, and
CR shielded wire from pin 6. Temporarily stow wires.

CR (b) Remove signal wires from pins 1 and 2, shielded
CR wire from pin 3 and install in pins 4, 5, and 6,
CR respectively.

CR (5) Reconnect plug 37.

CR (6) Close access panel opened in Step (2).

CR (7) Remove tags and close circuit breakers opened in Step
CR (1).

CR (8) On FE/SO lower panel, zone 215, locate ENGINE STATUS
CR panel.

CR (9) With A/FAN or B/TURB selected (switch latched in),
CR verify light on.

CR (10) Perform system BITE test (Ref. MM 77-31-00).

CR (11) Placard appropriate flight station pickup switchlight
CR inoperative and make log book entry to reflect
CR modification.

CR 5. AVM System Warning/Caution Lights

CR A. The Engine Vibration Monitoring (AVM) cockpit warning lists will soon be modified to comply with M.O. 94E49 (Lockheed Service Bulletin 093-77-052). This modification disconnects the AVM signal from the three red Vib-Turb Ovht Eng lights on the Caution and Warning Panel (CAWP) and relabels these lights Turb Air Ovht Eng. The amber Eng/APU Status warning light on the CAWP is redesignated Eng Vib Fltr Press. The APU signals are disconnected from this amber warning light, and the AVM signals are connected to it. The red warning lights in the AVM indicator on the Flight Engineer's engine status panel are replaced with amber lights.

CR B. After completion of Part 1 of this M.O., a revised Flight Handbook procedure can be used. As each aircraft is modified, a placard will be installed on the Captain's lower instrument panel. The placard will state, "AVM System Modified FOTB 83-2 Procedures Apply". The revised procedure will allow the flight crew to check the other (A or B) channel before shutting down when the AVM limit is exceeded. If the high AVM is only indicated on one channel, the engine will not be shutdown. When both AVM channels are high, the engine will be shutdown.

CR C. Maintenance action after an inflight shutdown for high AVM or filter pressure light on, has not changed. The TWA stock number for the AVM indicator with the amber light will be 31641.

VIBRATION MONITOR (VM) SYSTEM - ADJUSTMENT AND TEST

1. Equipment and Materials

Test Set, Rolls-Royce Ltd., A286-000-00 or equivalent

Cables, Rolls-Royce Ltd., PN A240-950-00, or equivalent

R AVO model 8 or equivalent DCO meter

R Test Set (Portable vibration analyzer), PN VM-3/X PN 1702419

Plug-in module, PN TSFM600M1

R Test cable adapter lead, PN 1702429

R Carrying case for PN 1702419 and 1702429, PN 1702428

Test Lead - Single conductor core (multistrand preferred) shielded coaxial cable (recommended minimum length, four feet) with BNC connector at one end and two 1 mm. plugs at the other end. (Center - red), (Shield = black) Local manufacture

2. Referenced Procedures

24-41-00	External Power/Ground Service System - Maintenance Practices
71-00-00	Power Plant - Maintenance Practices
71-11-00	Engines No. 1 and No. 3 Cowling - Maintenance Practices
71-12-05	LH and RH Upper Hinged Cowls - Servicing
77-31-00	Vibration Monitor System - Fault Isolation
77-31-03	VM Signal Conditioning Unit - Removal and Installation

3. Adjustment/Test

A. System Test

NOTE: On aircraft without SB77-038, PICKUP SELECTION switchlights are identified as FAN and TURB.

On aircraft with SB77-038, PICKUP SELECTION switchlights are identified as "A" and "B".

Perform system test as follows:

(1) Turn on electrical power (Ref. 24-41-00).

(2) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify that circuit breakers ENG VIB (R2) and ENG VIB LT (R3) are closed.

(3) On Flight Engineer/Second Officers lower panel, zone 215, locate ENGINE STATUS panel pushbutton TEST switch, FAN (or "A") and TURB (or "B") switchlights, filter band rotary switch, and BITE test switch on each vibration indicator.

(4) Depress and hold BITE test switch on each vibration indicator.

(5) Verify amber warning light comes on and pointer indicates approximately four units.

(6) Release test switch.

(7) Depress FAN (or "A") switchlight, depress and hold TEST switch, and rotate filter band switch through each of the four filter bands.

(8) Verify that FAN (or "A") switchlight, three vibration warning lights on vibration indicators and ENG VIB FLTR PRESS light on pilots CAWP comes on, and vibration indicator readings are approximately four units on each of the four filter bands.

C NOTE: Warning lights on vibration indicators should
C come on at approximately 2.5 units. There will
C be a few seconds delay before ENG VIB FLTR PRESS
C light on pilots CAWP remains on steadily. This
C is not a calibration test; it is only intended
C to be an operational check.

(9) Release TEST switch and FAN (or "A") switchlight.

(10) Verify lights remain on.

(11) Momentarily depress TEST switch.

(12) Verify lights go out.

(13) Depress TURB (or "B") switchlight, depress and hold TEST switch, and rotate filter band switch through each of the four filter bands.

(14) Verify that TURB (or "B") switchlight, three vibration warning lights on vibration indicators and ENG VIB FLTR PRESS light on pilots CAWP comes on, and vibration indicator readings are approximately four units on each of the four filter bands.

C NOTE: Warning lights on vibration indicators should
C come on at approximately 2.5 units. There will
C be a few seconds delay before ENG VIB FLTR PRESS
C light on pilots CAWP remains on steadily. This
C is not a calibration test; it is only intended
C to be an operational check.

(15) Release TEST switch and TURB (or "B") switchlight.

(16) Verify lights remain on.

(17) Momentarily depress TEST switch.

(18) Verify lights go out.

(19) Depress and hold TEST switch, rotate filter band switch through each of the four filter bands.

(20) Verify that three vibration warning lights on vibration indicators and ENG VIB FLTR PRESS light on pilots CAWP comes on, and vibration indicator readings are approximately four units on each of the four filter bands.

C NOTE: Warning lights on vibration indicators should
C come on at approximately 2.5 units. There will
C be a few seconds delay before ENG VIB FLTR PRESS
C light on pilots CAWP remains on steadily.

(21) Release TEST switch.

(22) Verify lights remain on.

(23) Momentarily depress TEST switch.

(24) Verify lights go out.

(25) Turn off electrical power (Ref. 24-41-00).

4. Functional Test (Test Set A286-000-00)

A. Prepare the test set as follows (Ref. Fig. 501):

(1) Set the function switch to CHECK BATT+ and verify that the pointer on the meter registers within BATT CHECK black segment.

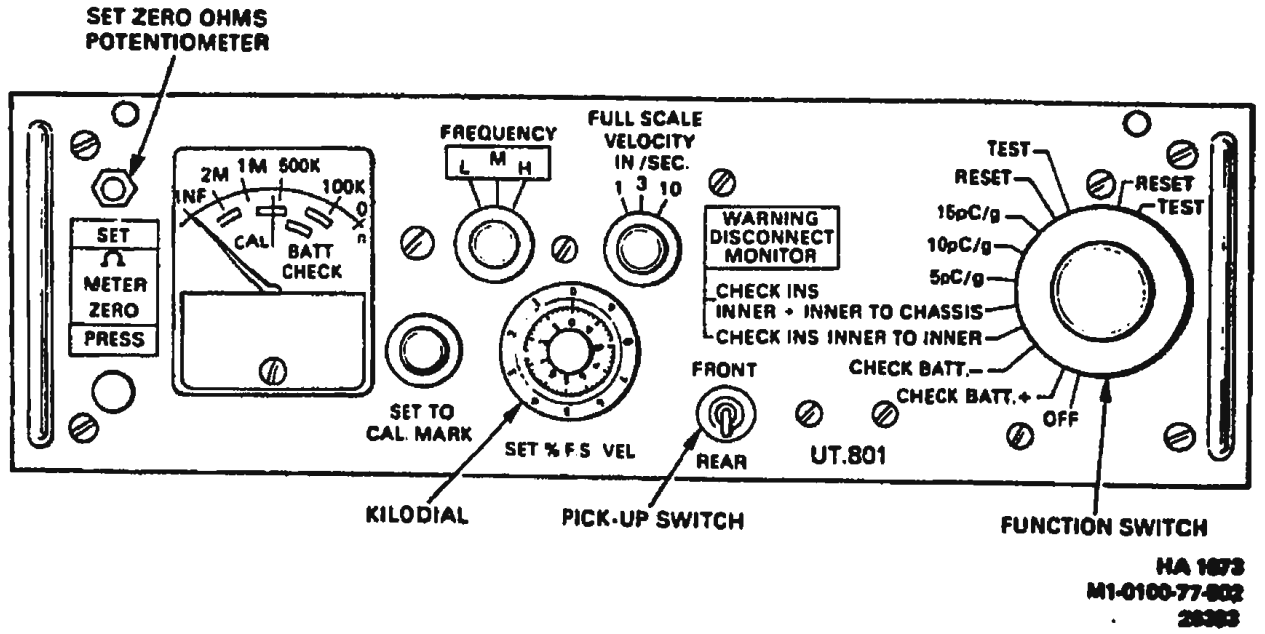
(2) Set the function switch to CHECK BATT- and verify that the pointer on the meter registers within BATT CHECK black segment.

(3) If the pointer does not register within black segment in Steps (1) or (2), change all test set batteries.

(4) Set function switch to CHECK INS. INNER TO INNER.

(5) Press the red SET OHMS METER ZERO button and verify that the meter pointer registers 0 ohms. If the meter pointer does not indicate 0 ohms, adjust to read 0 ohms by rotating the set zero ohms potentiometer.

(6) If the pointer cannot be adjusted to read 0 ohms, change the three 22.5 volt batteries, then check and reset 0 ohms.



Test Set Front Panel
Figure 501

B. Open LH hinged cowl 413A or 423A for engines No. 1 and 3 (Ref. 71-11-00), or LH upper hinged cowl 433DL for engine No. 2 (Ref. 71-12-05).

CAUTION: ENSURE ELECTRICAL CONNECTORS ARE FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE DISCONNECTING/CONNECTING. FAILURE TO DO SO COULD RESULT IN A FIRE.

C. Disconnect vibration pickup (plug T) at engine interface and connect to test set with cables (Ref. Fig. 502).

D. Test operation of vibration indicator transducer as follows:

(1) Set the pick-up switch to FRONT (Ref. Fig. 501).

(2) Set the function switch to the first RESET position and then to the first TEST position. Verify that the meter pointer registers in the green segment after approximately five seconds.

(3) Set the function switch to the second RESET position and then to the second TEST position. Verify that the meter pointer registers in the green segment after approximately five seconds.

NOTE: During Steps (2) and (3), if the pointer registers in the red segment, there is a fault in the intermediate pressure (IP) compressor case transducer or cable.

(4) Set the pick-up switch to REAR.

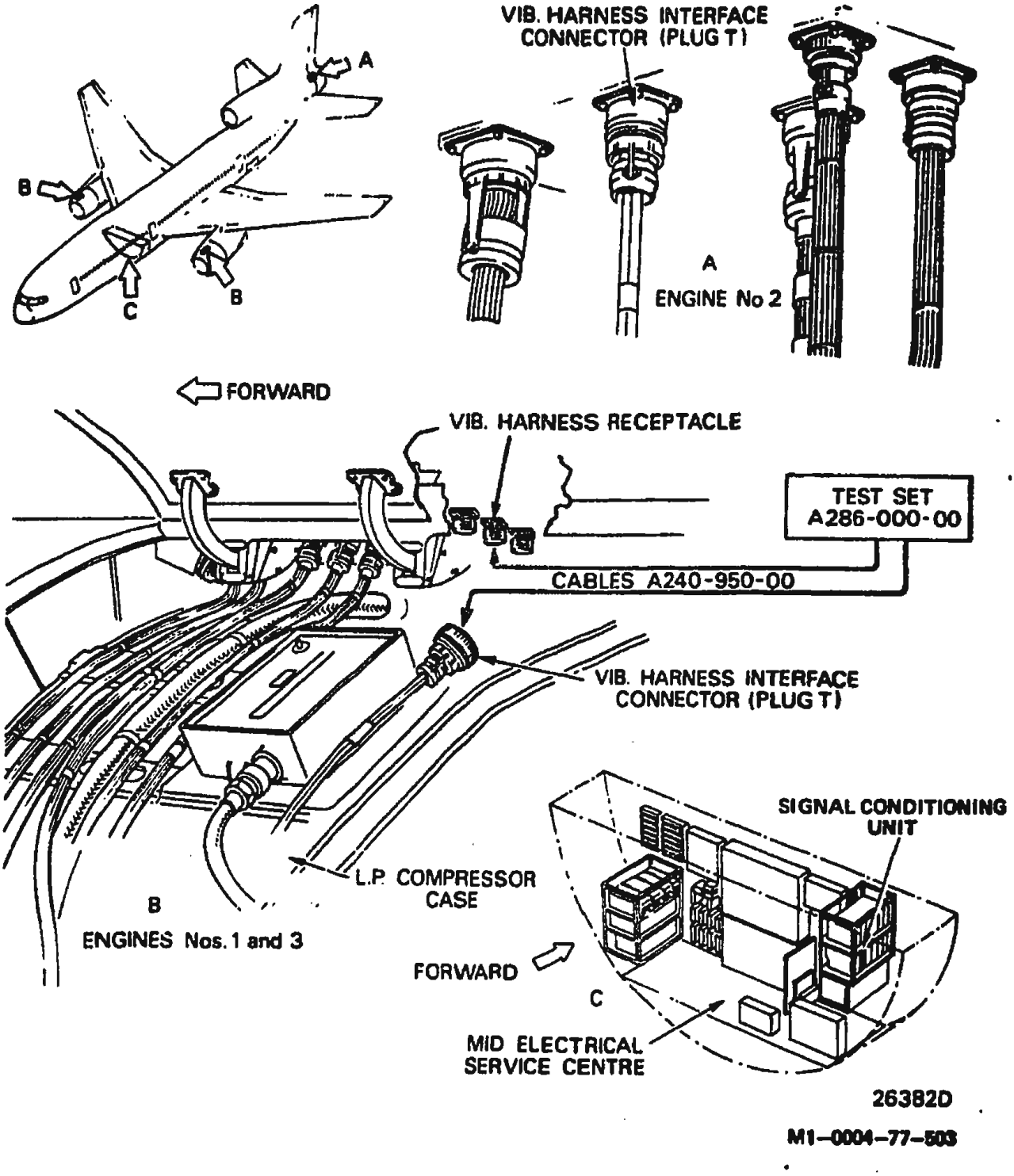
(5) Set the function switch to the first RESET position and then to the first TEST position. Verify that the meter pointer registers in the green segment after approximately five seconds.

(6) Set the function switch to the second RESET position and then to the second TEST position. Verify that the meter pointer registers in the green segment after approximately five seconds.

NOTE: During Steps (5) and (6), if the pointer registers in the red segment, there is a fault in the IP turbine case transducer or cable.

E. Test cable insulation from transducers to signal conditioning unit as follows:

CAUTION: THIS TEST MUST NOT BE CARRIED OUT WHILE SIGNAL CONDITIONING UNIT IS CONNECTED.



Test Set Connect Points
Figure 502

(1) Remove VM signal conditioning unit (Ref. 77-31-03).

(2) Set the function switch to CHECK INS. INNER TO INNER (Ref. Fig. 501).

(3) Set the pick-up switch to FRONT.

(4) Press the red SET OHMS METER ZERO button and verify that the pointer on the meter indicates 0 ohms. If the meter pointer does not indicate 0 ohms, adjust to read 0 ohms by rotating set zero ohms potentiometer.

(5) Release SET OHMS METER ZERO button and verify that meter reading is not less than 1M ohm.

NOTE: This check indicates a satisfactory insulation resistance between the two conductors in the IP compressor case transducer cable up to engine/aircraft interface disconnect.

(6) Raise flap on top of the test set; press the black button and verify that the meter reading is not less than 1M ohm.

NOTE: This indicates a satisfactory insulation resistance between the two conductors in the IP compressor case transducer cable from the engine/aircraft interface disconnect to the signal conditioning unit disconnect.

(7) Set the function switch to CHECK INS. INNER + INNER TO CHASSIS and repeat Steps (5) and (6).

(8) Set the pick-up switch to REAR.

(9) Set the function switch to CHECK INS. INNER TO INNER.

(10) Verify that meter reading is not less than 1M ohm.

NOTE: This check indicates a satisfactory insulation resistance between the two conductors in the IP turbine case transducer cable up to engine/aircraft interface disconnect.

(11) Raise flap on top of test set; press the black button and verify that the meter reading is not less than 100K ohms.

NOTE: This check indicates a satisfactory insulation resistance between the two conductors in the IP turbine case transducer cable from

engine/aircraft interface disconnect to the signal conditioning unit disconnect.

(12) Set the function switch to CHECK INS. INNER + INNER TO CHASSIS and repeat Steps (10) and (11).

(13) Install the VM signal conditioning unit (Ref. 77-31-03).

R F. Test Cable Screen Continuity (Engines Without SB72-3732)

R CAUTION: ENSURE ELECTRICAL CONNECTORS ARE FREE FROM LIQUID
R AND/OR SOLID CONTAMINATION BEFORE
R DISCONNECTING/CONNECTING.

R (1) Disconnect vibration harness interface connector (plug
R T) at engine/aircraft interface (Ref. Fig. 502).

R (2) Connect one lead of AVO model 8 to the relevant earth
R connection in plug T, eigher pin 10 for channel A or
R pin 5 for channel B transducers. Insulate exposed
R metal parts at this connection.

R (3) Connect the other lead of AVO model 8 to engine
R metalwork.

R (4) Gently manipulate the vibration cable where it enters
R junction box connector at plug T side of junction box.
R Any change in resistance reading is unacceptable. A
R resistance reading of greater than 0.5 ohms is
R unacceptable.

R NOTE: Failure to meet either of these requirements
R indicates a poor or intermittent screen in the
R clicker nut assembly. The vibration cable
R between junction box and plug T must be
R replaced.

R G. Test Operation of the VM indicator as follows:

(1) Turn on electrical power (Ref. 24-41-00).

R (2) Set the test set function switch to 10pC/g (Ref. Fig.
R 501).

R (3) Set the FREQUENCY selector to L.

R (4) Adjust SET TO CAL MARK control until the meter pointer is aligned with the CAL mark in the blue segment.

R (5) Set the FULL SCALE VELOCITY selector to 3 IN./SEC.

R (6) Rotate SET % F.S. VEL kilodial until the outer scale reads 5 and the inner scale reads 33.

R (7) Set the pick-up switch to FRONT.

R (8) On the Flight Engineer/Second Officers ENGINE STATUS
R panel, select channel A ensuring that channel B
R switchlight is unlatched.

R (9) Set rotary switch on ENGINE STATUS panel to LOW and
R check that pointer on relevant vibration indicator
R indicates 4 (±0.8) units.

(10) Set the rotary switch on the ENGINE STATUS panel first
R to MED then to HIGH and verify that the applicable vibration indicator pointer does not exceed 1.25 units in either selection.

(11) Set the test set FREQUENCY selector to M.

(12) Adjust SET TO CAL MARK control until the meter pointer is aligned with the CAL mark in the blue segment.

(13) Set the rotary switch on the ENGINE STATUS panel to MED
R and verify that the applicable vibration indicator indicates 4 (±0.8) units.

R (14) Set the rotary switch first to LOW then to HIGH and verify that the applicable vibration indicator pointer does not exceed 1.25 units at either selection.

(15) Set the test set FREQUENCY selector to H.

(16) Adjust SET TO CAL MARK control until the meter pointer is aligned with the CAL mark in the blue segment.

(17) Set the rotary switch on the ENGINE STATUS panel to
R HIGH and verify that the applicable vibration indicator indicates 4 (±0.8) units.

R (18) Set the rotary switch first to MED then to LOW and verify that the applicable vibration indicator pointer does not exceed 1.25 units at either selection.

(19) Set the rotary switch on the ENGINE STATUS panel to NORM.

(20) Set test set FREQUENCY selector to L, then M, then H,
R and repeat Steps (4) and (8) at each position ensuring
R that the relevant vibration indicator reads 4 (±0.8)
R units.

(21) Set pick-up switch on test set to REAR.

(22) Repeat Steps (8) through (20) only with channel B selected on the ENGINE STATUS panel, noting that channel A is unlatched.

H. Test system warning light setting as follows:

(1) Turn on electrical power (Ref. 24-41-00).

(2) Set the test set function switch to 10pC/g (Ref. Fig. 501).

R (3) Set pickup switch to FRONT.

R (4) Set the FREQUENCY selector to L.

R (5) Adjust SET TO CAL MARK control until the meter pointer is aligned with the CAL mark in the blue segment.

R (6) Set the FULL SCALE VELOCITY selector to 3 IN./SEC.

R (7) On ENGINE STATUS panel, select channel A with channel B switchlight unlatched and set rotary switch to NORM.

R (8) Slowly rotate the inner scale and verify that the warning light in the applicable ENGINE STATUS panel vibration indicator comes on when the kilodial reads 3.33 and the vibration indicator indicates 2.5 (±0.25) units.

NOTE: Ensure that the inner scale is rotated slowly as there is approximately a 7-second delay before the indicator corresponds with the kilodial setting.

R (9) Turn off electrical power (Ref. 24-41-00).

J. Test accuracy of vibration indicator as follows:

(1) Turn on electrical power (Ref. 24-41-00).

(2) Set the test set function switch to 10pC/g (Ref. Fig. 501).

(3) Set the FREQUENCY selector to L.

(4) Adjust SET TO CAL MARK control until the meter pointer is aligned with the CAL mark in the blue segment.

(5) Set the FULL SCALE VELOCITY selector to 3 IN/SEC.

(6) On ENGINE STATUS panel select channel A ensuring channel B switchlight is unlatched.

(7) Set the SET % F.S. VEL kilodial outer and inner scales to 1st setting indicated on Table 501.

Vibration Indicator Accuracy Test
Table 501

SETTING	SET % F.S. VEL OUTER SCALE	INNER SCALE	VIBRATION INDICATOR READING
1st	1	33	1 (±0.2) Units
2nd	2	67	2 (±0.4) Units
3rd	4	00	3 (±0.6) Units
4th	5	33	4 (±0.8) Units

(8) Set the pick-up switch to FRONT.

(9) Verify that the applicable vibration indicator reading corresponds to the 1st reading in Table 501.

(10) Set the SET % F.S. VEL kilodial to the 2nd setting in Table 501.

(11) Verify that the vibration indicator reading corresponds to the 2nd reading in Table 501.

(12) Set the SET % F.S. VEL kilodial to the 3rd setting in Table 501.

(13) Repeat Steps (8) through (11) and verify that the vibration indicator reading corresponds to the 3rd reading in Table 501.

(14) Set the SET % F.S. VEL kilodial to the 4th setting in Table 501.

(15) Verify that the vibration indicator reading corresponds to the 4th reading in Table 501.

(16) Repeat Steps (7) through (15) for MED and HIGH settings of rotary switch on the ENGINE STATUS panel and the corresponding M and H settings on the test set FREQUENCY selector. After selecting M and H settings adjust the SET TO CAL MARK control until the pointer on

the meter is aligned with the CAL mark in the blue segment.

(17) Repeat Steps (7) through (15) only with channel B selected on ENGINE STATUS panel and with test set pick-up switch to rear.

(18) Turn off electrical power (Ref. 24-41-00).

CAUTION: ENSURE ELECTRICAL CONNECTORS ARE FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE DISCONNECTING/CONNECTING. FAILURE TO DO SO COULD RESULT IN A FIRE.

(19) Set function switch to OFF; disconnect and remove the test set and cables, connect the vibration pick-up (plug T) at engine/aircraft interface.

(20) Close the LH hinged cowl 413A or 423A for engines No. 1 and 3 (Ref. 71-11-00), or 433DL for engine No. 2 (Ref. 71-12-05).

4. Functional Test (Test Set VM-3/X)

A. Prepare Test Set As Follows (Ref. Fig. 503):

(1) Connect test cable adaptor lead to test set input (31).

(2) Remove protective cap (19) and insert pen in holder.

(3) Using switch (28), check battery state (27), if battery low, connect plug (21) to mains supply and check (29) goes on.

(4) Set FREQUENCY RANGE (14) to 30-300 HZ.

(5) Set TRANSDUCER SELECT (11) to MAGN.

(6) Set SENSITIVITY (10) to 145 MV/INCH/SEC.

(7) Set MEASURING MODE (9) to NARROW BAND.

(8) Set RANGE (8) to 10/SEC pK.

(9) Using switch (4) select pen lift.

(10) Set TRACK/SCAN SELECTOR (2) to STANDBY.

(11) Set SUPPLY MODE (1) to ON.

(12) Set X AXIS CONTROLS (rear panel) to TACHO 1 (24) and CAL (25).

B. Test Set Self Test

(1) Carry out all operations in Para. A.

(2) Set RANGE selector (8) to TEST and insert card in slot (20).

R (3) Set TRACK/SCAN SELECTOR (2) to AUTOSCAN.

R (4) Depress switch (4) fully to select START SCAN. Wait
R until pen has traversed card and returned to zero
R position.

R (5) Using switch (4), select PEN LIFT and set SUPPLY MODE (1) to OFF.

R (6) Remove card which should display analysis of a 45HZ test signal (and additional harmonics). The amplitude of the test signal should be between 60% and 90% of full scale deflection.

R (7) The test set is operational, if the self test results are satisfactory.

C. Connect Test Set to Vibration Signal Conditioner As Follows:

(1) On FE/SO aft circuit breaker panel CB3, zone 215, open and tag circuit breaker ENGINE VIB (R2).

(2) Gain access to mid electrical service center and remove signal conditioner (Ref. 77-31-03).

(3) Remove six retaining screws and remove lid. Do not touch contents as static electricity can damage the electronic components.

(4) Identify module of engine to be investigated (Ref. Fig. 504).

(5) Locate monitor points on top of selected engine channel module and connect the 1 mm. pins of the test cable as follows:

Signal (red) to monitor point TP1

Signal (black) to monitor point TP8

(6) Using four longer screws which were removed from lid (retain two shorter screws for reinstallation), secure

conditioner contents by replacing them in their original positions and gently tighten.

NOTE: Lid is not reinstalled at this time.

(7) Install signal conditioner (Ref. 77-31-03), ensuring monitor points are not disturbed then secure test lead to convenient metalwork using adhesive tape.

(8) Connect BNC connector to test cable adaptor and thus to test set.

(9) On FE/SO aft circuit breaker panel CB3, zone 215, remove tag and close circuit breaker ENGINE VIB (R2).

D. AVM System Noise Analysis

(1) Set range (8) to 0.3/sec pk.

(2) Insert new card in slot (20) and set TRACK/SCAN SELECTOR (2) to AUTOSCAN.

(3) On ENGINE STATUS panel, zone 215, select vibration channel to be investigated, FAN (A) or TURB (B), then set filter selection switch to NORM.

(4) With all engines static, ensure all electrical busses are powered up and interior lights switched ON. In addition, if it is suspected that some electrical system (i.e. HF Radio or PA system) is causing AVM interference, ensure that the relevant equipment is in operation if possible.

R (5) Depress switch (4) fully to select START SCAN. When pen has traversed card, using switch (4) select PEN LIFT and set SUPPLY MODE (1) to off.

(6) Remove card and repeat test if necessary with alternative channel selected.

(7) Examine card(s) obtained. A normal AVM system will show a straight line (with only minor irregularities) with zero amplitude. Should noise be present causing the line to rise above or approach one third of the height of the card, unacceptable noise levels are present. In such cases, refer to 77-31-00 Fault Isolation before proceding with this test.

E. Engine Vibration Analysis

(1) Set RANGE (8) to 10/sec pk.

(2) Insert new card in slot (20) and set TRACK/SCAN SELECTOR (2) to AUTOSCAN.

(3) On engine status panel, zone 215, select vibration channel to be investigated FAN (A) or TURB (B), then set filter selection switch to NORM.

(4) Start engine (Ref. 71-00-00) on which vibration analysis is to be performed and run at ground idle for 5 minutes.

(5) Slowly advance throttle lever to achieve desired EPR or EPR corresponding to maximum vibration level, allow parameters to stabilize, and record engine shaft speeds.

R (6) Depress switch (4) fully to select START SCAN. Wait until pen has traversed card and returned to zero position.

(7) Using switch (4), select PEN LIFT and set SUPPLY MODE (1) to off.

(8) If required, repeat Step 4D(6) with alternative channel selected on engine status panel. Review cards in accordance with G (Analysis of Test Set Results), repeat tests as necessary.

(9) Stop engine (Ref. 71-00-00).

F. Return Engine to Flight Status As Follows:

(1) On FE/SO aft circuit breaker panel CB3, zone 215, open and tag circuit breaker ENGINE VIB (R2).

(2) Remove signal conditioner (Ref. 77-31-03) and adhesive tape securing test lead to metalwork.

(3) Remove test pins from monitor points in signal conditioner.

(4) Remove four screws temporarily installed on signal conditioner in Step 4C(6).

(5) Install signal conditioner lid with four long screws and two short screw.

NOTE: The short screws are used to secure the aft end of signal conditioner lid.

(6) Install signal conditioner unit (Ref. 77-31-03).

(7) On FE/SO aft circuit breaker panel CB3, zone 215, remove tag and close circuit breaker ENGINE VIB (R2).

(8) On engine status panel, zone 215, press and hold vibration test button. Check that the three vibration indicators read 4±0.5 units and that the warning lights go on when the indicators pass through 2.5 units.

(9) Release test button when all checks are complete.

G. Analysis of Test Set Results [Ref. Fig. 505 (Sheets 1 through 4)]

(1) The test set displays a plot of vibration level against frequency, at a given power setting. The amplitude of the vibration signal is expressed in inches per second peak, 2 inches per sec. being full scale deflection of the card. This corresponds to full scale deflection of vibration monitoring indicator (5 units) on flight engineers panel.

(2) The frequency of vibration is expressed in cycles/sec. (HZ), which can be read directly from the card. To convert to engine RPM multiply by 60.

100% N1 = 3900 RPM = 65HZ

100% N2 = 7000 RPM = 117HZ

100% N3 = 10611 RPM = 177HZ

(3) A typical vibration survey [Ref. Fig. 505 (Sheet 1)] shows three peaks representing L.P., I.P. and H.P. rotor vibration. A small peak twice the I.P. frequency may be visible. This is a normal characteristic of the engine.

(4) If test set card shows a vibration spectrum, which does not have three peaks corresponding to rotor speeds, then rotor unbalance should not be associated with apparent vibration.

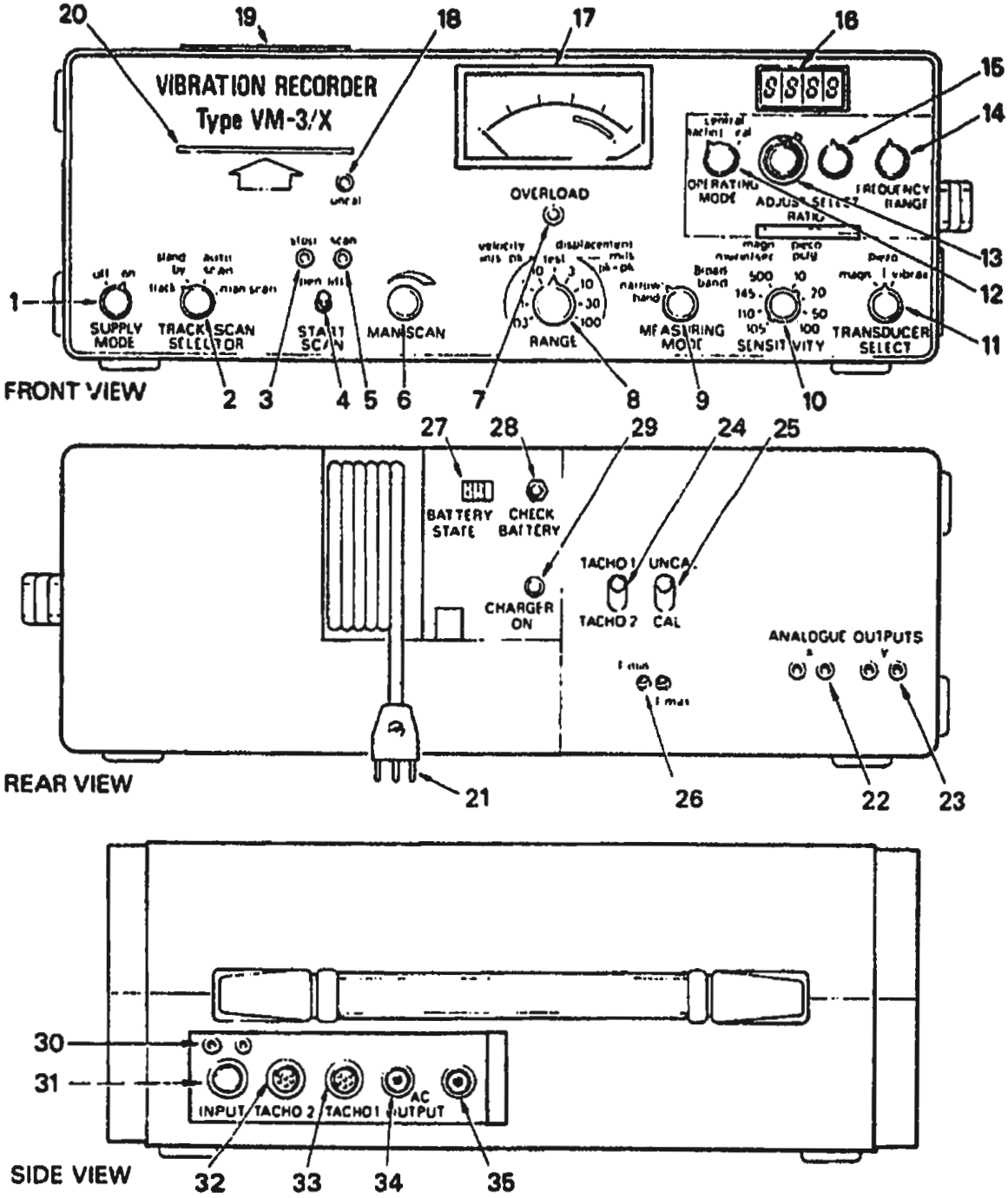
(5) If the additional non engine order related data is at low frequency, it will usually be caused by vibration system wiring faults between transducer and signal conditioner such as: outer cover indentation, poor connections, failure to remove black impregnated coating from AVM signal wires prior to entry into plug "T" and unsecured lengths of cable.

(6) High frequency non engine related data is usually caused by: electrical interference (i.e. aircraft

400HZ, boarding music, H.F. radio etc.). A loose vibration transducer can also cause high frequency noise.

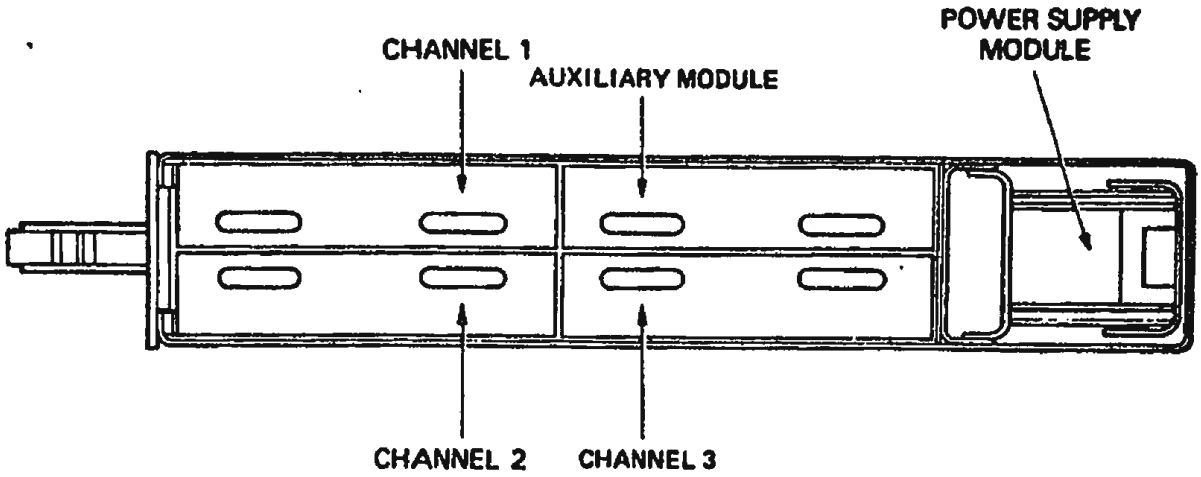
(7) A distinct vibration peak at approximately 85% of either IP or HP rotor speed, which maintains this relationship independent of engine speed, is normally indicative of oil in the compressor drum. A typical trace showing oil in the IP compressor drum can be seen in Fig. 505 (Sheet 4).

(8) If engine vibration spectrum is not clean, isolate cause and rectify (Ref. 87-31-00, Fault Isolation).



68083
M1-0000-77-277

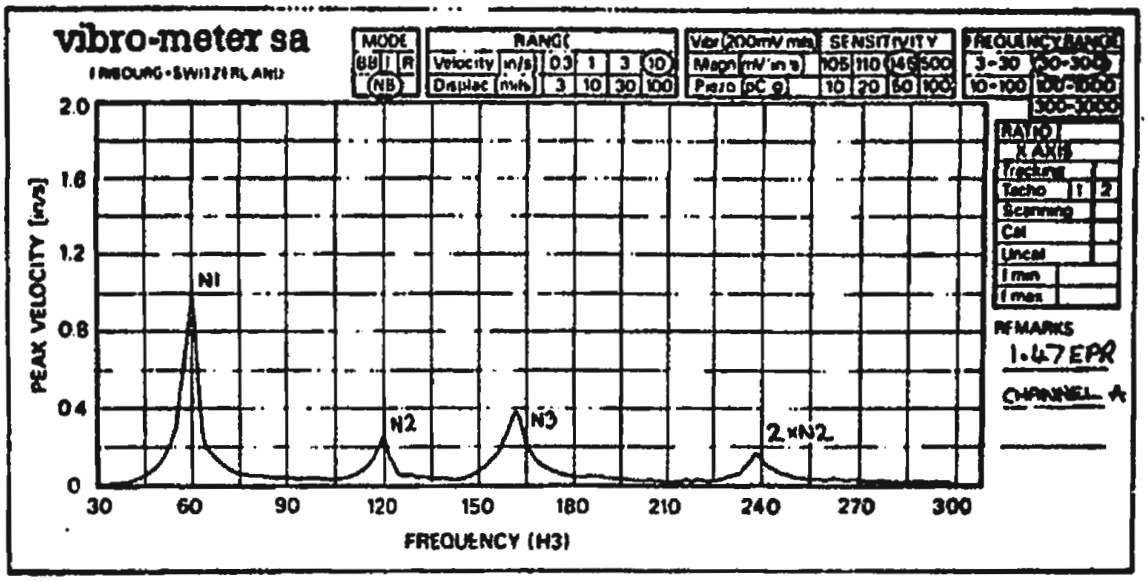
Vibration Analysis Recorder - VM-3/X
Figure 503



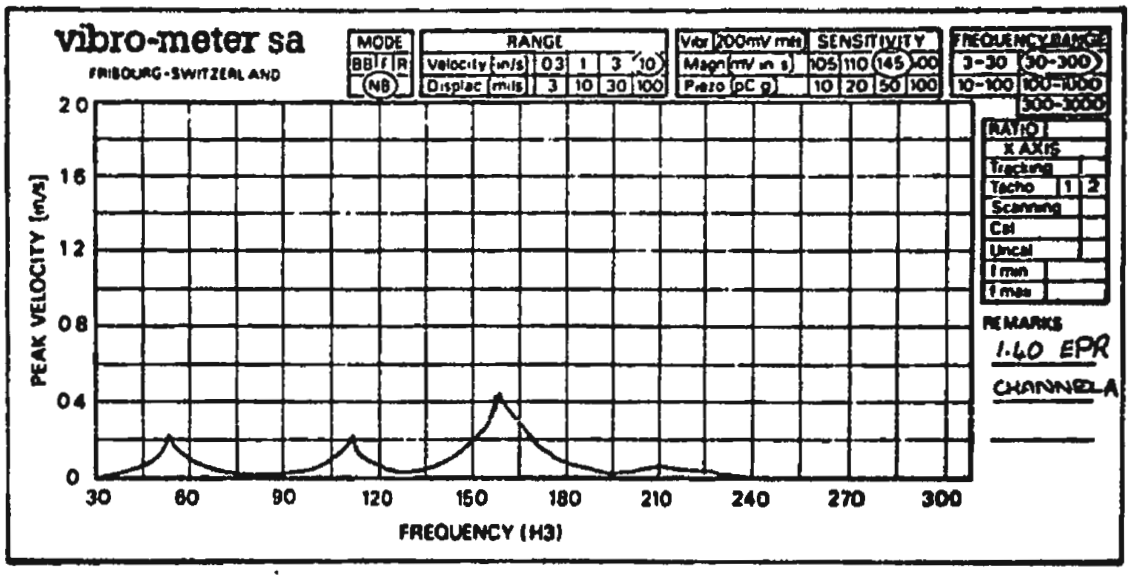
LOCATION DIAGRAM — PLUG IN MODULES

68082
M1-0000-77-278

Signal Conditioner - Channel Location
Figure 504



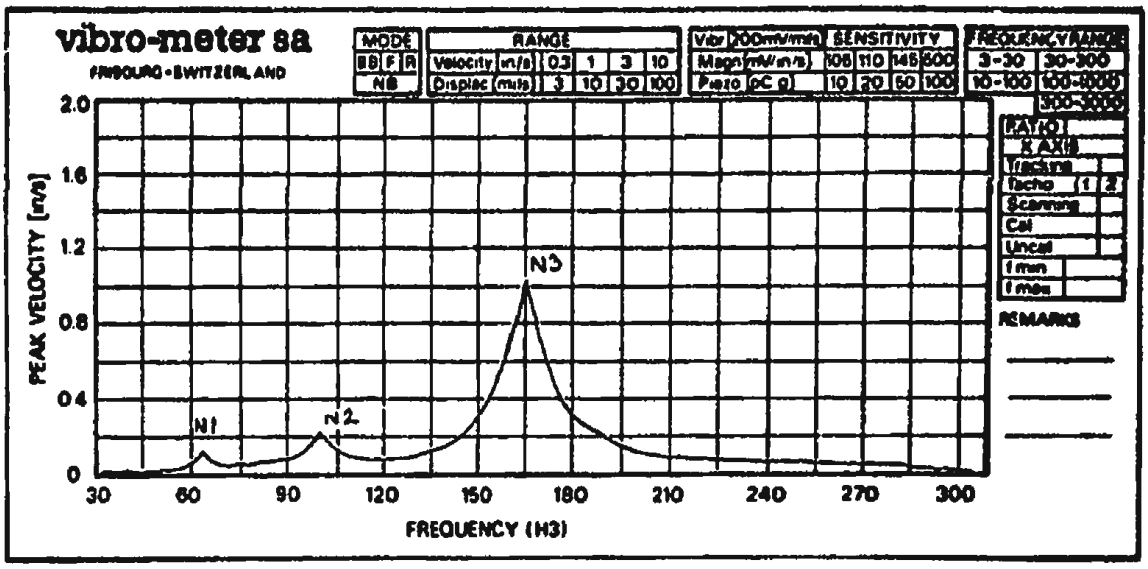
Data good, N1 rotating system out of balance



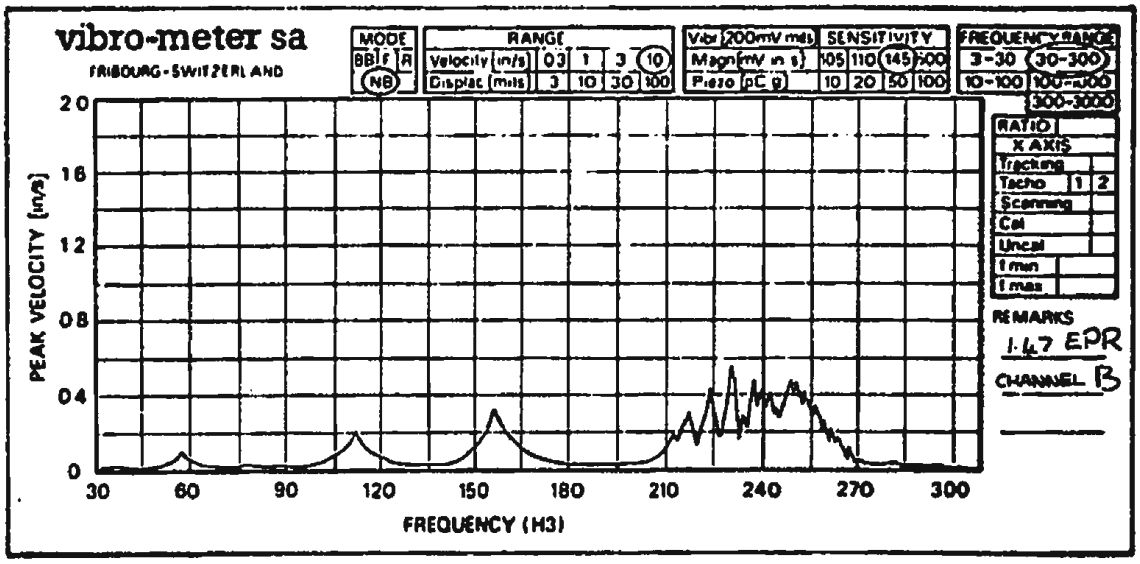
Typical good data

68204
M1-0000-77-279

Analysis of Test Set Results
Figure 505 (Sheet 1)



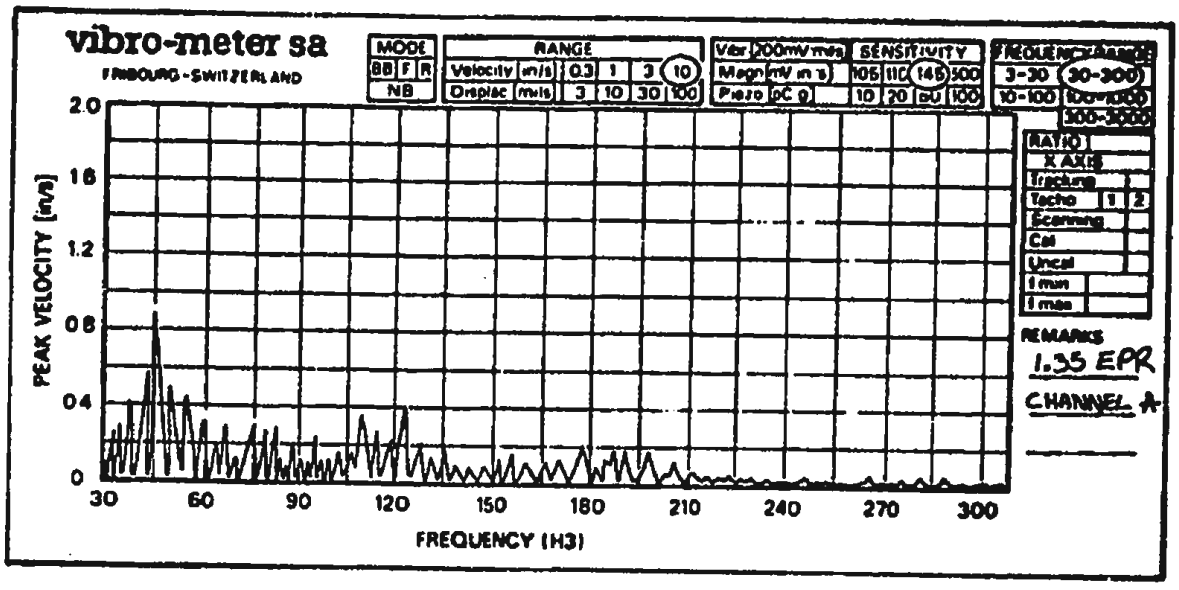
Data good, N3 rotating system out of balance



High frequency noise due to incorrect bolting of turbine vibration pick up support bracket

68206
M1-0000-77-280

Analysis of Test Set Results
Figure 505 (Sheet 2)

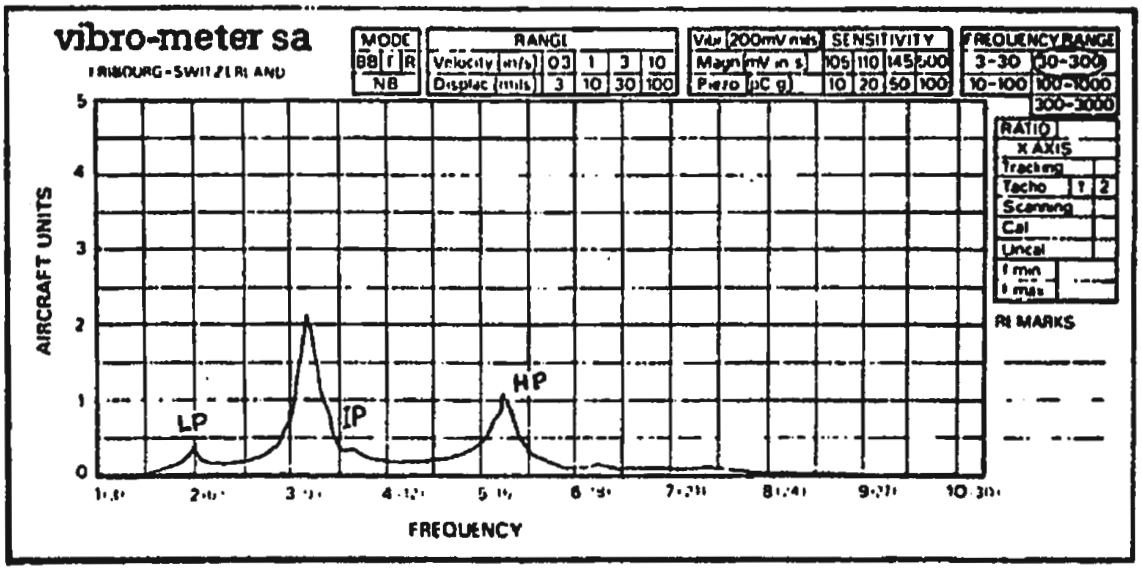


No engine vibration data visible on card.
Intermittent open circuit between pick up and signal conditioner, suspect cable connector interface

68206
M1-0000-77-281

Analysis of Test Set Results
Figure 505 (Sheet 3)

R EFFECTIVITY: ALL
R
001B



84630
M1-0000-77-302

R Analysis of Test Set Results
R Figure 505 (Sheet 4)

R EFFECTIVITY: ALL
R
001B

VIBRATION INDICATOR TRANSDUCER - REMOVAL AND INSTALLATION

1. General

On engines without RR SB72-3310 and RR SB77-4644, one transducer is located on the Intermediate Pressure (I.P.) compressor case left-hand side (viewed from the rear) and one on the I.P. turbine case right-hand side.

On engines without RR SB72-3310, with RR SB77-4644, the I.P. turbine case transducer is relocated on the I.P. compressor case left-hand side below the original I.P. compressor case transducer.

On engines with RR SB72-3310, without RR SB77-4644, the I.P. compressor case transducer is relocated on the I.P. compressor case right-hand side. The other transducer remains in position on the I.P. turbine case right-hand side.

R On engines with RR SB72-3310 and RR SB7277-4644, both transducers are relocated adjacent each other on the I.P. compressor case right-hand side.

On engines with RR SB77-5387, both transducers are positioned adjacent each other and both junction boxes are positioned adjacent each other on the I.P. compressor case right-hand side.

NOTE: On engines with RR SB77-4644 and RR SB77-5387, the removal/installation procedure for both transducers is identical.

On engines with RR SB77-3732, the transducer on the I.P. compressor is rotated 180 degrees, but the removal/installation procedure and location is unchanged.

2. Equipment and Materials

CP. 20309 or XUT. 37594	Working platform
or (XUT. 42526)	Spacer
(XUT. 42527)	Side piece

AVO or similar test equipment

Lock-wire, Fed Spec QQ-W-390, 0.032-inch diameter; British Spec
R DTD. 189A 22 SWG; or equivalentGrease, British Spec DTD.
R 900/4914 Rocol GG.17866; Omat item 404A.

3. Referenced Procedures

R 70-02-01 Identification, Lubrication and Fitting of Rubber
R Sealing Rings

72-03-00 Gas Generator Fairings - Removal/Installation

77-31-00 Vibration Monitor (VM) System - Adjustment/Test

78-30-00 Thrust Reverser-Servicing

Service Bulletins Referred to:

RR SB71-5325 - Introduction of L.P. Compressor (fan case)/A Frame to Engine Services Loom Assembly Incorporating Vibrometer Connectors.

R RR SB72-3198 - Splitter Nose Section - Introduction of Anchor Nuts for Securing Fire Seal Housing - Seal Housing and Backing Plate in Two Halves.

RR SB72-3732 - Light Duty Harness Re-routed Through "A" Frame.

RR SB72-3310 - Compressor Intermediate Case - Introduction of a Steel Fabricated Case.

RR SB77-2603 - Revised Clipping of V.P.U. Cable on Combustion Outer Case Front Flange.

RR SB77-3168 - Vibration Transducers and Cables Improved Insulation and Locking Arrangement.

RR SB77-3254 - Repositioned Vibration Junction Box - Splitter Disconnect Bulkhead.

RR SB77-4416 - Introduction of Vibration Transducer Improved Connector.

RR SB77-4644 - Vibration Indicating System - Repositioned Vibration Transducer.

RR SB77-5169 - Vibration Transducer - Introduction of Earth Bonding Lead.

RR SB77-5322 - IP Compressor and IP Turbine Case - Improved Wirelocking of Vibration Transducer Connector.

RR SB77-5387 - Introduction of a Revised Vibration Monitoring System.

RR SB77-5388 - Introduction of Improved Vibrometer Connector Type CG 505.

RR SB77-5506 - Vibration Indication System - shortened Transducer Rear Lead

RR SB77-5856 - Engine indicating system - Hexagon headed bolts securing the vibration transmitter (transducer) on the airborne vibration monitoring system.

RR SB77-5922 - Vibration Indication System - modified transducer mounting

4. Removal/Installation

WARNING: ENSURE THRUST REVERSER SYSTEM IS LOCKED IN FORWARD THRUST POSITION WHILE WORK IS IN PROGRESS.

R CAUTION: ACCELEROMETERS FEATURE DELICATE COMPONENTS IN THEIR
R INTERNAL CONSTRUCTION AND MUST THEREFORE BE TREATED
R WITH EXTREME CARE. IF SUBJECTED TO IMPACT, DAMAGE MAY
R RESULT.

A. On Engines Without RR SB72-3310,
Removal of IP Compressor Case Transducer.

NOTE: On engines with RR SB77-4644, the removal procedure for both transducers is identical.

(1) Deactivate and tag thrust reverser and associated systems and install thrust reverser locks (Ref. 78-30-00).

(2) On Pilots overhead circuit breaker panel CB1, zone 210, open and tag applicable circuit breaker ENGINE START CONT (E13, E14 or E15).

On FE/SO aft circuit breaker panel CB3, zone 215, open and tag applicable circuit breakers ENG VIB (R2) and ENG VIB LT (R3).

(3) Position working platform in cold stream duct.

(4) Remove compressor section rear LH fairing 412FL for engine No. 1, 422FL for engine No. 3 or 432FL for engine No. 2 (Ref. 72-03-00).

(5) Remove transducer as follows (Ref. Fig. 401):

(a) On engines without RR SB77-4416, remove locking clip (1).

CAUTION: ENSURE THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE DISCONNECTING.

(b) Unscrew connecting nut (2) or (6) and withdraw lead assembly (3) or (7) from transducer electrical receptacle.

(c) On engines without RR SB77-5388, remove and discard seal ring.

(c) On engines with RR SB77-5388, remove and discard nickel washer.

(d) Remove screws or bolts (4) then remove transducer (5).

NOTE: On engines with RR SB77-4416, note position of locking tab before removing transducer.

R CAUTION: ACCELEROMETERS FEATURE DELICATE COMPONENTS IN THEIR
R INTERNAL CONSTRUCTION AND MUST THEREFORE BE TREATED
R WITH EXTREME CARE. IF SUBJECTED TO IMPACT, DAMAGE MAY
R RESULT.

A. On Engines With RR SB72-3310, Removal of IP Compressor Case Transducer.

NOTE: On engines with RR SB77-4644, the removal procedure for both transducers is identical.

On engines with RR SB72-3732, the transducer location on the IP compressor case is unchanged but the transducer is rotated 180 degrees.

(1) Deactivate and tag thrust reverser and associated systems and install thrust reverser locks (Ref. 78-30-00).

(2) On Pilots overhead circuit breaker panel CB1, zone 210, open and tag applicable circuit breaker ENGINE START CONT (E13, E14 or E15).

On FE/SO aft circuit breaker panel CB3, zone 215, open and tag applicable circuit breakers ENG VIB (R2) and ENG VIB LT (R3).

(3) Position working platform in cold stream duct.

(4) Remove compressor section rear RH fairing 412FR for engine No. 1, 422FR for engine No. 3 or 432FR for engine No. 2 (Ref. 72-03-00).

(5) On engines with/without RR SB77-4644 and without RR SB77-5506, remove transducer as follows (Ref. Fig. 401):

(a) On engines without RR SB77-4416, remove locking clip (1).

(b) Unscrew connecting nut (2) or (6) and withdraw lead assembly (3) or (7) from transducer electrical receptacle.

(c) On engines without RR SB77-5388, remove and discard seal ring.

(c) On engines with RR SB77-5388, remove and discard nickel washer.

(d) Remove screws or bolts (4) and remove transducer (5).

NOTE: On engines with RR SB77-4416, note position of locking tab.

On engines with RR SB77-5169, note position of bonding lead.

(5) On engines with RR SB77-4644 and RR SB77-5506, remove transducer as follows (Ref. Fig. 401):

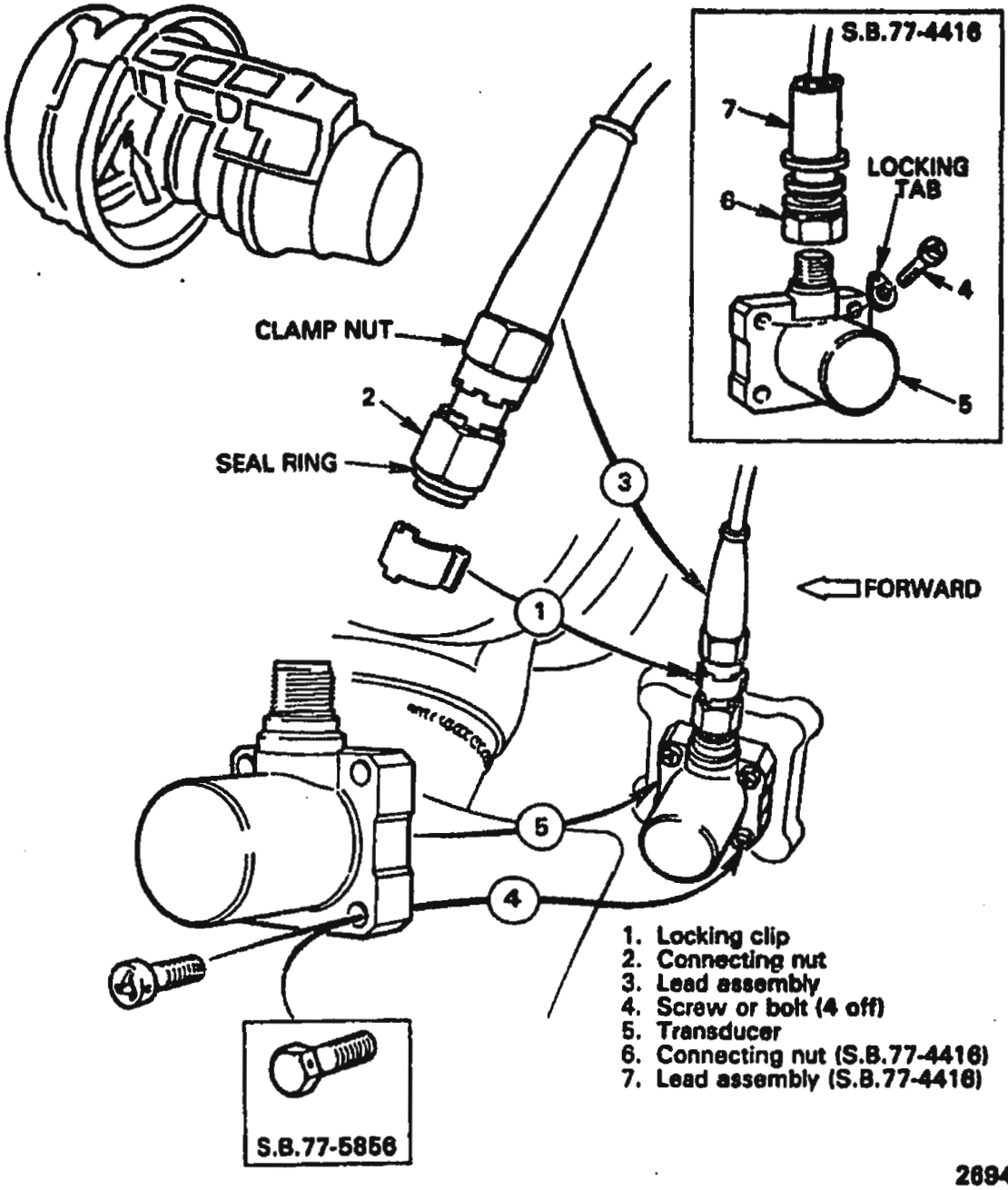
(a) Unscrew connecting nut (1) and withdraw lead assembly (6) from transducer electrical receptacle.

(6) Remove and discard nickel washer (2).

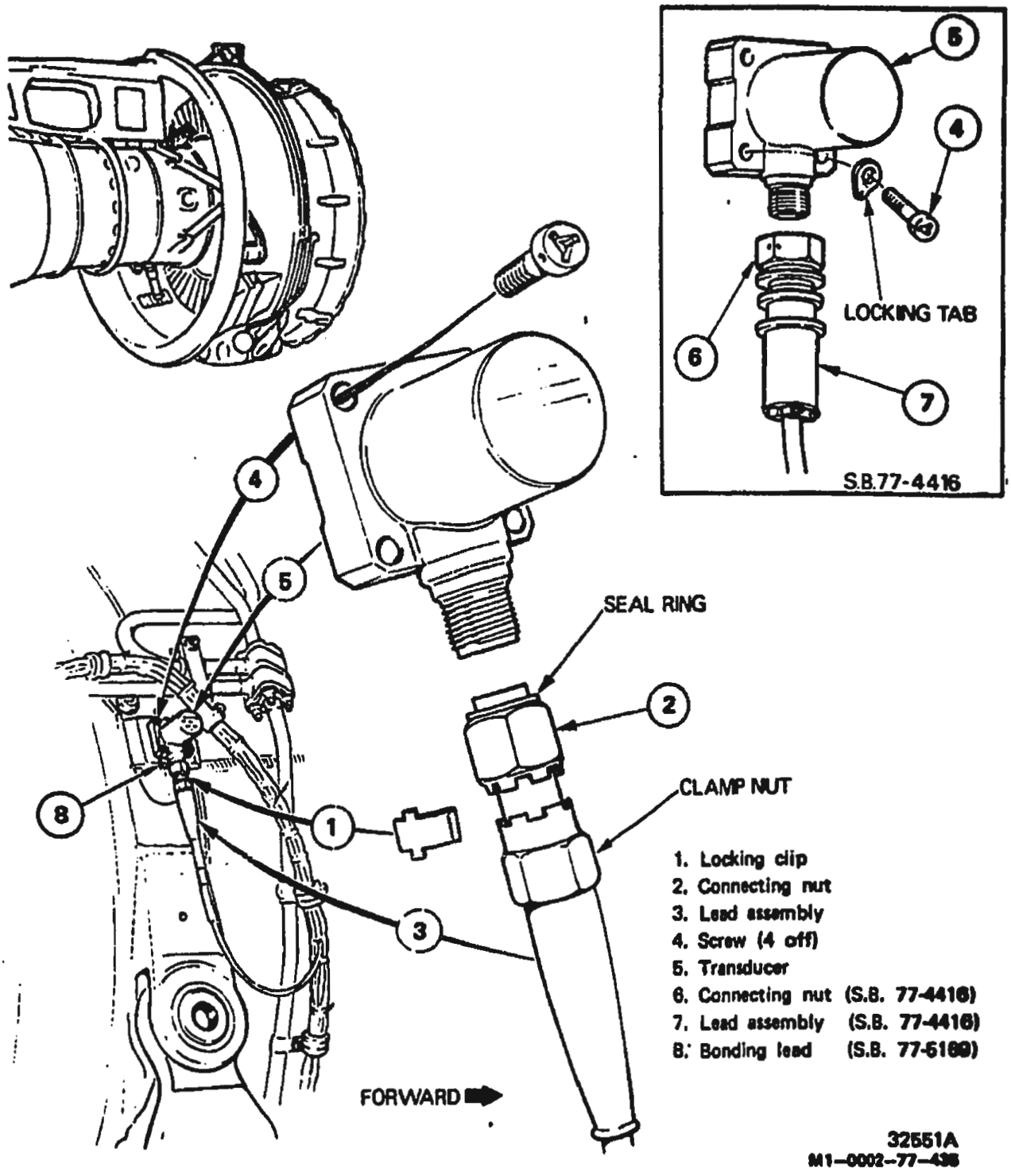
(c) Remove bolts (3) noting position of lock tab (4), then remove transducer (5).

NOTE: On engines with RR SB77-5169, note position of bonding lead.

R CAUTION: ACCELEROMETERS FEATURE DELICATE COMPONENTS IN THEIR
R INTERNAL CONSTRUCTION AND MUST THEREFORE BE TREATED
R WITH EXTREME CARE. IF SUBJECTED TO IMPACT, DAMAGE MAY
R RESULT.



R IP Compressor Case Transducer
R Figure 401

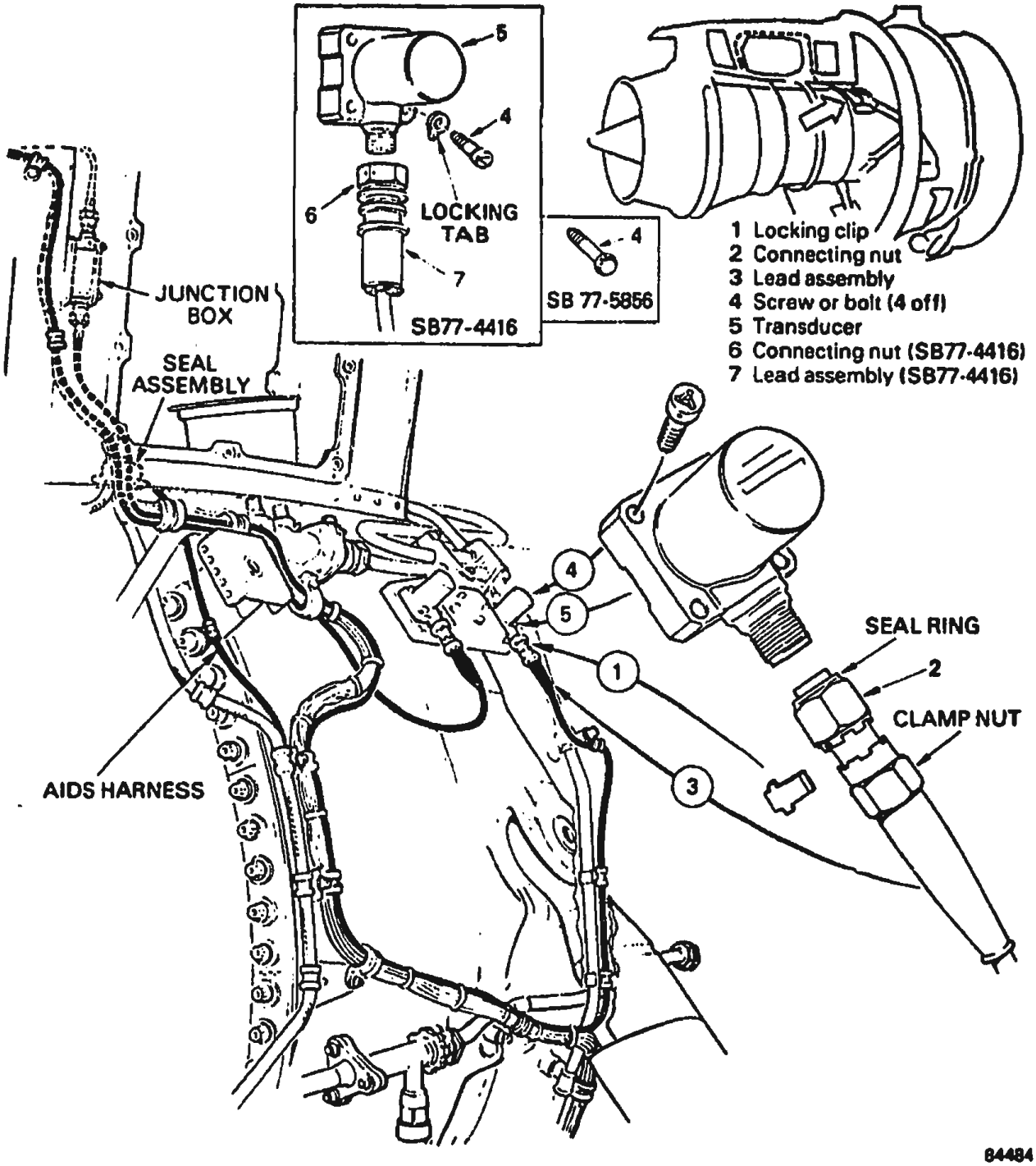


R
R

IP Compressor Case Transducer
Figure 401

EFFECTIVITY: WITH RR SB72-3310

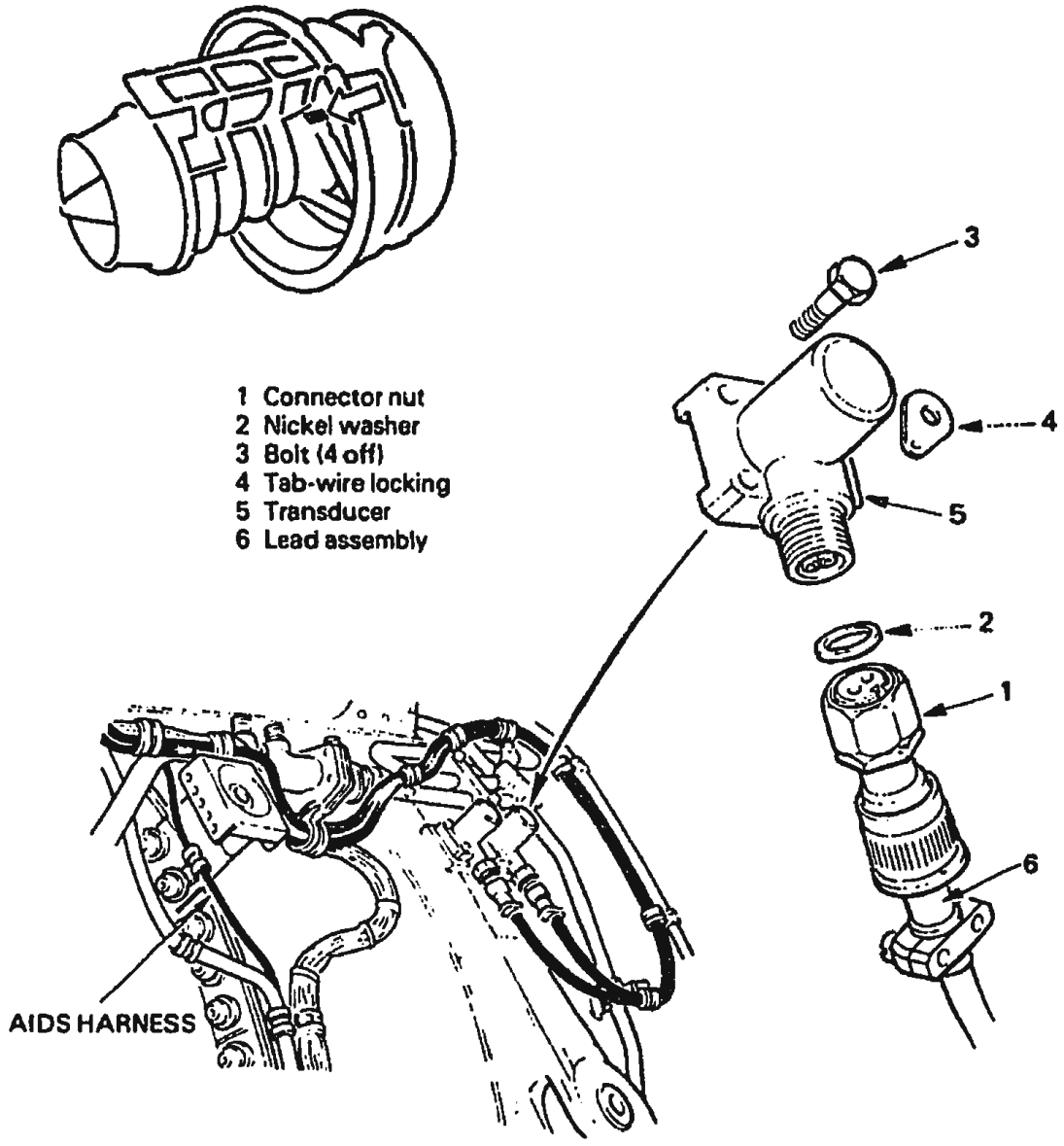
001B



84484
M1-0000-77-306

R IP Compressor Case Transducer
R Figure 401

EFFECTIVITY: ENGINES WITH RR SB72-3310
AND RR SB77-4644



84483
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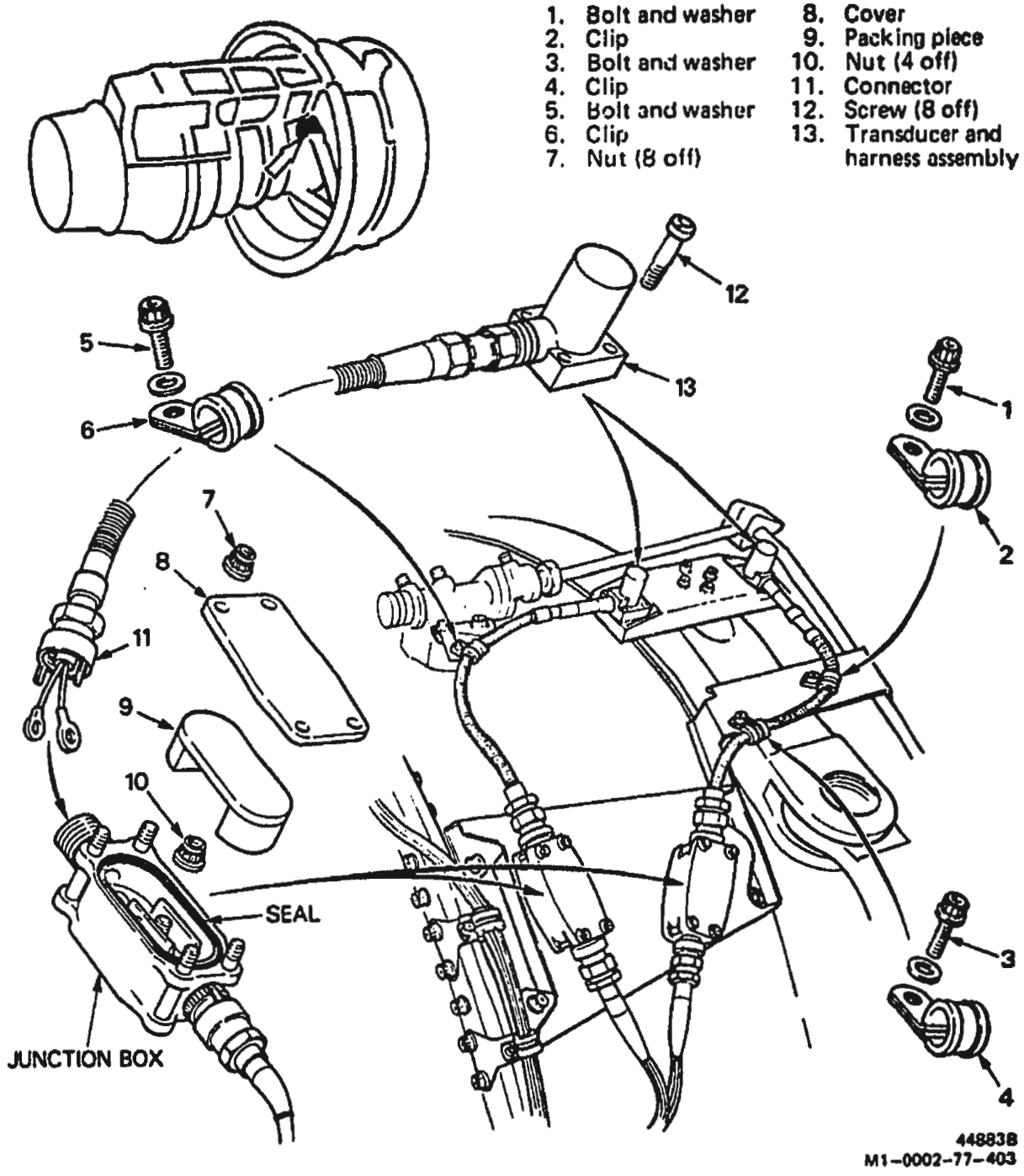
R IP Compressor Case Transducer
R Figure 401

EFFECTIVITY: ENGINES WITH RR SB72-3310
AND RR SB77-5506

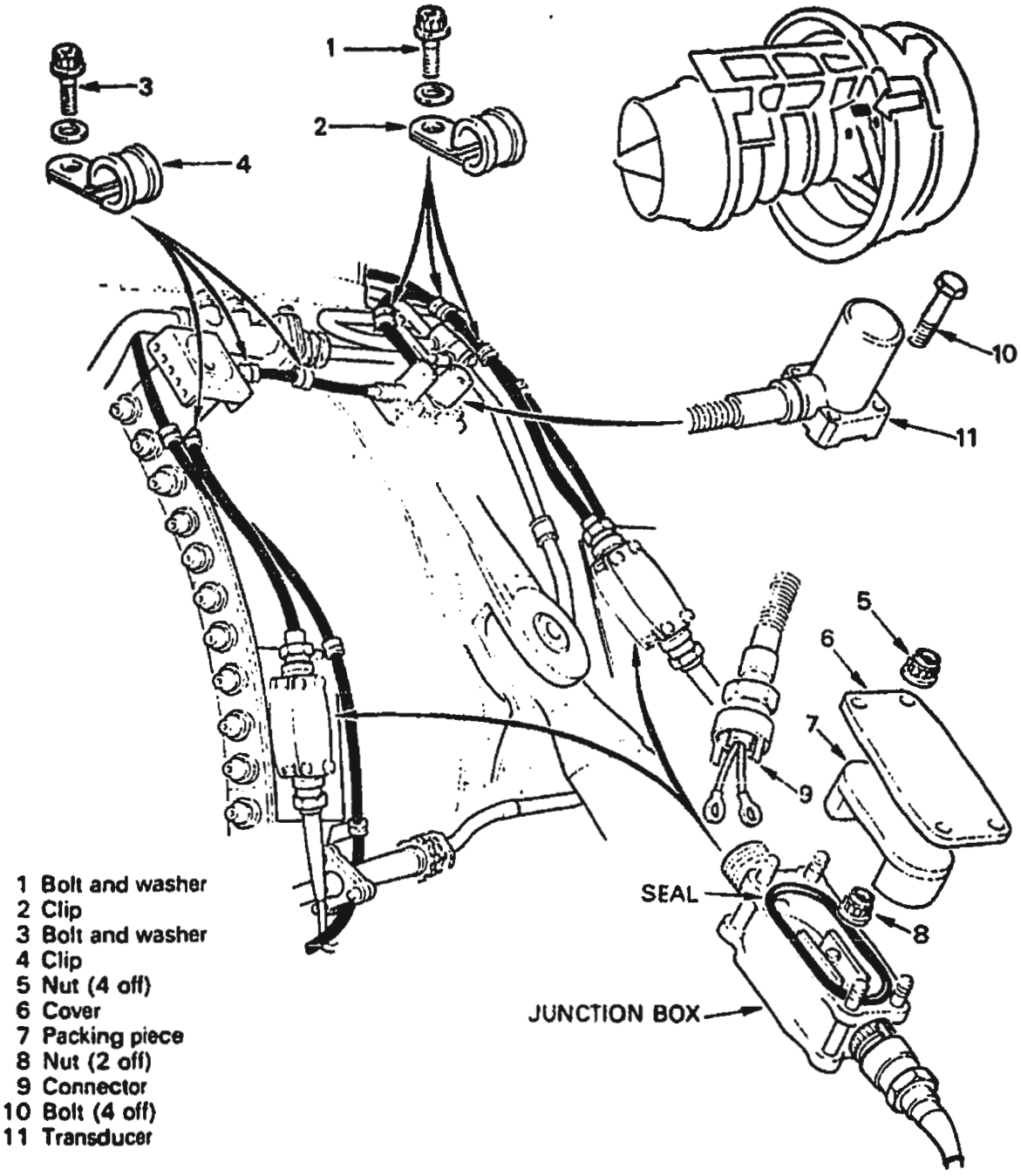
001B



R IP Compressor Case Transducer
R Figure 401

EFFECTIVITY: WITH RR SB77-5387

001B



1 Bolt and washer
2 Clip
3 Bolt and washer
4 Clip
5 Nut (4 off)
6 Cover
7 Packing piece
8 Nut (2 off)
9 Connector
10 Bolt (4 off)
11 Transducer

68092
M1-0000-77-309

R IP Compressor Case Transducer
R Figure 401

EFFECTIVITY: ENGINES WITH RR SB77-5922

001B

B. On Engines Without RR SB72-3310, Installation of IP Compressor Case Transducer.

NOTE: On engines with RR SB77-4644, the installation procedure for both transducers is identical.

(1) Ensure that thrust reverser is locked and systems are deactivated and tagged as described in Step 4A(2).

(2) Position working platform in cold stream duct.

(3) On engines without RR SB77-4416, install transducer as follows (Ref. Fig. 401):

(a) On engines without RR SB77-5388, Install transducer (5) on compressor case with screws or bolts (4). Lock-wire screws or bolts (4).

(a) On engines with RR SB77-5388, install transducer (5) on compressor case with screws or bolts (4) and locking tab. Lock-wire screws or bolts (4).

NOTE: Install locking tab on screw nearest transducer electrical receptacle.

CAUTION: ENSURE A NEW SEAL RING IS IN POSITION AT SHOULDER OF LEAD ASSEMBLY (3).

ENSURE THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(b) On engines without RR SB77-5388, slide back connecting nut (2), install new seal ring on lead assembly (3) then fully insert lead assembly into transducer electrical receptacle (Ref. 70-02-01).

NOTE: Ensure positive location of key.

CAUTION: ENSURE A NEW NICKEL WASHER IS IN POSITION AT SHOULDER OF LEAD ASSEMBLY (3).

ENSURE THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(b) On engines with RR SB77-5388, slide back connecting nut (2), install a new

nickel washer on lead assembly (3) then fully insert lead assembly into transducer electrical receptacle.

NOTE: Ensure positive location of key.

CAUTION: DO NOT TURN CLAMP NUT.

(c) On engines without RR SB77-5388, screw connecting nut (2) onto transducer and torque to 60 lb in. (6.78 Nm).

(c) On engines with RR SB77-5388, screw connecting nut (2) onto transducer and torque to 60 lb in. (6.78 Nm). Utilizing locking tab lock-wire connecting nut.

CAUTION: DO NOT LOOSEN CONNECTING NUT (2) TO ALIGN RECESSES. DO NOT EXCEED 100 LB IN. (11.31 Nm) TORQUE ON CONNECTING NUT.

(d) On engines without RR SB77-5388, install locking clip (1). If necessary tighten connecting nut (2) slightly to align recesses in connecting and clamp nuts with lugs on locking clip.

(e) On engines with RR SB77-3168, lock-wire locking clip (1).

(3) On engines with RR SB77-4416, install transducer as follows (Ref. Fig. 401).

(a) Install transducer (5) on compressor case with screws or bolts (4) and locking tab. Lock-wire screws or bolts (4).

NOTE: Install locking tab on screw nearest transducer electrical receptacle.

CAUTION: ENSURE THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(b) On engines without RR SB77-5388, slide back connecting nut (6) and fully insert lead assembly (7) into transducer electrical receptacle.

NOTE: Ensure positive location of key.

CAUTION: ENSURE A NEW NICKEL WASHER IS IN POSITION AT SHOULDER OF LEAD ASSEMBLY (7).

ENSURE THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(b) On engines with RR SB77-5388, slide back connecting nut (6), install a new nickel washer on lead assembly (7) then fully insert lead assembly into transducer electrical receptacle.

NOTE: Ensure positive location of key.

(c) On engines without RR SB77-5322, screw connecting nut (6) onto transducer then torque to 60 lb in. (6.78 Nm) and lock-wire.

(c) On engines with RR SB77-5322

(i) Apply a thin film of grease to transducer connector threads. Screw connecting nut (6) onto transducer then torque 60 to 100 lb in. (6.78 to 11.31 Nm). Wipe off excess grease.

(ii) Using a single length of lock-wire, lock-wire units together in the following sequence:

Locking tab to connecting nut (6).

Connecting nut (6) to connector body and lead assembly (7).

(iii) Using a separate length of lock-wire, lock-wire connector body to lead assembly (7).

(4) Install compressor section rear LH fairing removed in STEP 4A(4).

(5) Remove working platform from cold stream duct.

(6) Unlock and reactivate thrust reverser and associated systems (Ref. 78-30-00).

(7) Remove tags and close circuit breakers opened in Step 4A(2).

R CAUTION: ACCELEROMETERS FEATURE DELICATE COMPONENTS IN THEIR
R INTERNAL CONSTRUCTION AND MUST THEREFORE BE TREATED
R WITH EXTREME CARE. IF SUBJECTED TO IMPACT, DAMAGE MAY
R RESULT.

B. On Engines With RR SB72-3310,
Installation of IP Compressor Case Transducer.

NOTE: On engines with RR SB77-4644,
the installation procedure for both transducers is identical.

On engines with RR SB72-3732,
the transducer location on the IP compressor case is unchanged but the transducer is rotated 180 degrees.

(1) Ensure that thrust reverser is locked and systems are deactivated and tagged as described in Step 4A(2).

(2) Position working platform in cold stream duct.

(3) On engines without RR SB77-4416, with/without RR SB77-4644, and without RR SB77-5506,
install transducer as follows (Ref. Fig. 401):

(a) On engines without RR SB77-5169 and RR SB77-5388,
install transducer (5) on compressor case with screws or bolts (4). Lock-wire screws or bolts (4).

(a) On engines with RR SB77-5169,
install transducer on compressor case with screws or bolts (4) and bonding lead (8). Lock-wire screws or bolts (4).

NOTE: Ensure contact surface of transducer (5) and bonding lead (8) is clean.

Install bonding lead (8) at lower rear screw position.

(a) On engines with RR SB77-5388,
install transducer (5) on compressor case with screws or bolts (4) and locking tab. Lock-wire screws or bolts (4).

NOTE: Install locking tab on screw nearest transducer electrical receptacle.

CAUTION: ENSURE A NEW SEAL RING IS IN POSITION AT SHOULDER OF LEAD ASSEMBLY (3).

ENSURE THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(b) On engines without RR SB77-5388, slide back connecting nut (2), install new seal ring on lead assembly (3) then fully insert lead assembly into transducer electrical receptacle (Ref. 70-02-01).

NOTE: Ensure positive location of key.

CAUTION: ENSURE A NEW NICKEL WASHER IS IN POSITION AT SHOULDER OF LEAD ASSEBMLY (3).

ENSURE THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(b) On engines with RR SB77-5388, slide back connecting nut (2), install a new nickel washer to lead assembly (3) then fully insert lead assembly into transducer electrical receptacle.

NOTE: Ensure positive location of key.

CAUTION: DO NOT TURN CLAMP NUT.

(c) On engines without RR SB77-5388, screw connecting nut (2) onto transducer then torque to 60 lb in. (6.78 Nm).

(c) On engines with RR SB77-5388, screw connecting nut (2) onto transducer and torque to 60 lb in. (6.78 Nm). Utilizing locking tab lock-wire connecting nut.

CAUTION: DO NOT LOOSEN CONNECTING NUT (2) TO ALIGN RECESSES.

DO NOT EXCEED 100 LB IN. (11.31 Nm) TORQUE ON CONNECTING NUT.

(d) On engines without RR SB77-5388, install locking clip (1). If necessary tighten connecting nut (2) slightly to align recesses in connecting and clamp nuts with lugs on locking clip.

(e) On engines with RR SB77-3168, lock-wire locking clip (1).

(3) On engines with/without RR SB77-4416, with RR SB77-4644 and RR SB77-5506, install transducer as follows (Ref. Fig. 401):

(a) On engines without RR SB77-5169, with/without RR SB33-5388, install transducer (5) on compressor case and secure with bolts (3) and locking tab (4). Lock-wire bolts (3).

NOTE: Install locking tab on bolt nearest transducer electrical receptacle.

(a) On engines with RR SB77-5169, ensuring contact surface of transducer (5) and bonding lead is clean, install transducer on compressor case and secure with bolts (3), bonding lead, and locking tab (4). Lock-wire bolts.

NOTE: Install locking tab on bolt nearest transducer electrical receptacle, and bonding lead at rear lower bolts.

CAUTION: ENSURE A NEW NICKEL WASHER (2) IS INSTALLED ON SHOULDER OF LEAD ASSEMBLY (6).

ENSURE ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(a) On engines with RR SB77-5506,

(i) Slide back connecting nut (1) and install new nickel washer (2) on level assembly (6).

(ii) Fully insert lead assembly into transducer electrical receptacle.

NOTE: Ensure positive location of key.

(iii) Screw connecting nut (1) onto transducer then torque to 60 lb-in. (6.78Nm) and lock-wire.

(3) On engines with RR SB77-4416 or RR SB71-5325, with/without RR SB77-4644, and without RR SB77-5506, install transducer as follows (Ref. Fig. 401).

(a) On engines with/without RR SB77-5388, and without RR SB71-5169,

install transducer (5) on compressor case with screws (4) and locking tab. Lock-wire screws (4).

NOTE: Install locking tab on screw nearest transducer electrical receptacle.

(a) On engines with RR SB71-5169,
install transducer on compressor case with screws (4), locking tab and bonding lead. Lock-wire screws (4).

NOTE: Ensure contact surface of transducer (5) and bonding lead is clean.

Install locking tab with screw nearest transducer electrical receptacle.

Install bonding lead at lower rear screw position.

CAUTION: ENSURE THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(b) On engines without RR SB77-5388,
slide back connecting nut (6) and fully insert lead assembly (7) into transducer electrical receptacle.

NOTE: Ensure positive location of key.

CAUTION: ENSURE A NEW NICKEL WASHER IS IN POSITION AT SHOULDER OF LEAD ASSEMBLY (7).

ENSURE THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(b) On engines with RR SB77-5388,
slide back connecting nut (6), install a new nickel washer on lead assembly (7) then fully insert lead assembly into transducer electrical receptacle.

NOTE: Ensure positive location key.

(c) On engines without RR SB77-5322, with/without RR SB77-5388,
screw connecting nut (6) onto transducer. Torque to 60 lb in. (6.78 Nm) and lock-wire.

(c) On engines with RR SB77-5322

(i) Apply a thin film of grease to transducer connector threads. Screw connecting nut (6) onto transducer, then torque 60 to 100 lb in. (6.78 to 11.31 Nm). Wipe off excess grease.

(ii) Using a single length of lock-wire, lock-wire units together in the following sequence:

Locking tab, to connector nut (6).

Connecting nut (6), to connector body and lead assembly (7).

(iii) Using a separate length of lock-wire, lock-wire connector body to lead assembly (7).

(4) Install compressor section rear RH fairing removed in Step 4A(4).

(5) Remove working platform from cold stream duct.

(6) Unlock and reactivate thrust reverser and associated systems (Ref. 78-30-00).

(7) Remove tags and close circuit breakers opened in Step 4A(2).

R CAUTION: ACCELEROMETERS FEATURE DELICATE COMPONENTS IN THEIR
R INTERNAL CONSTRUCTION AND MUST THEREFORE BE TREATED
R WITH EXTREME CARE. IF SUBJECTED TO IMPACT, DAMAGE MAY
R RESULT.

C. On Engines With RR SB77-5387, Removal of IP Compressor Case Transducer.

NOTE: The removal procedure for both transducers is identical.

(1) Deactivate and tag thrust reverser and associated systems and install thrust reverser locks (Ref. 78-30-00).

(2) On Pilots overhead circuit breaker panel CB1, zone 210, open and tag applicable circuit breaker ENGINE START CONT (E13, E14 or E15).

On FE/SO aft circuit breaker panel CB3, zone 215, open and tag applicable circuit breakers ENG VIB (R2) and ENG VIB LT (R3).

(3) Position working platform in cold stream duct.

(4) Remove compressor section RH upper fairing 412AR for engine No. 1, 422AR for engine No. 3 or 432AR for engine No. 2(Ref. 72-03-00).

(5) Remove transducer as follows (Ref. Fig. 401):

(a) If forward transducer and harness assembly is being removed, remove bolt and washer (1), clip (2), bolt and washer (3) and clip (4).

If rear transducer and harness assembly is being removed, remove bolt and washer (5) and clip (6).

NOTE: Retain clips for reuse with replacement transducer and harness assembly.

(b) Remove nuts (7), cover (8) and packing piece (9).

(c) Remove nuts (10) and lift harness leads off terminal posts.

(d) Disconnect connector (11) and withdraw harness leads from junction box.

(e) Remove screws or bolts (12) then remove transducer and harness assembly (13).

(6) On engines with RR SB77-5922, remove transducer as follows (Ref. Fig. 401):

(a) If forward transducer and harness assembly is being removed, remove bolts and washers (1) and clips (2).

(a) If rear transducer and harness assembly is being removed, remove bolts and washers (3) and clips (4).

NOTE: Retain clips for reuse with replacement transducer and harness assembly.

(b) Remove nuts (5), cover (6) and packing piece (7).

(c) Remove nuts (8) and lift harness leads from terminal posts.

(d) Disconnect connector (9) and withdraw harness leads from junction box.

(e) Remove bolts (10) and transducer and harness assembly (11).

R CAUTION: ACCELEROMETERS FEATURE DELICATE COMPONENTS IN THEIR
R INTERNAL CONSTRUCTION AND MUST THEREFORE BE TREATED
R WITH EXTREME CARE. IF SUBJECTED TO IMPACT, DAMAGE MAY
R RESULT.

D. On Engines With RR SB77-5387,
Installation of IP Compressor Case Transducer.

NOTE: The installation of both transducers is identical.

(1) Ensure thrust reverser and associated systems are deactivated and tagged as described in Step 4C(2).

(2) Position working platform in cold stream duct.

(3) Install transducer as follows (Ref. Fig. 401):

(a) Install transducer and harness assembly (13) on mounting bracket with screws or bolts (12). Lock-wire screws or bolts (12).

(b) Insert harness leads into junction box connector and locate over junction box terminal posts. Install harness on terminal posts and secure with nuts (10).

(c) Screw connector (11) onto junction box and secure.

(d) Position seal in junction box recess and install packing piece (9) (legs first) into junction box. Install cover (8) and secure with nuts (7).

NOTE: Replace seal if cracked or frayed.

(e) Install clips removed in Step 4C(5)(a) onto replacement transducer and harness assembly.

(f) If rear transducer and harness assembly is being replaced, align clip (6) with bracket on IP compressor case and secure with bolt and washer (5).

(f) If forward transducer and harness assembly is being replaced, align clips (2) and (4) with bracket on IP compressor case and secure with bolts and washers (1) and (3).

(4) On engines with RR SB77-5922, install transducer as follows (Ref. Fig. 401):

(a) Install transducer and harness assembly (11) on mounting bracket and secure with bolts (10). Lock-wire bolts.

(b) Insert harness leads through junction box connector and locate over junction box terminal posts and secure with nuts (8).

(c) Screw connector (9) onto junction box and secure.

(d) Position seal in junction box recess and install packing piece (7) (legs first) in junction box. Install cover (6) and secure with nuts (5).

NOTE: Replace seal if cracked or frayed.

(e) If rear transducer and harness assembly is being replaced, install clips (4) on harness assembly and secure with bolts and washers (3).

(e) If forward transducer and harness assembly is being replaced, install clips (2) on harness assembly and secure with bolts and washers (1).

(5) Install compressor section RH upper fairing removed in Step 4C(4).

(6) Remove working platform from cold stream duct.

(7) Unlock and reactivate thrust reverser and associated systems (Ref. 78-30-00).

(8) Remove tags and close circuit breakers opened in Step 4C(2).

R CAUTION: ACCELEROMETERS FEATURE DELICATE COMPONENTS IN THEIR
R INTERNAL CONSTRUCTION AND MUST THEREFORE BE TREATED
R WITH EXTREME CARE. IF SUBJECTED TO IMPACT, DAMAGE MAY
R RESULT.

E. On Engines Without RR SB77-4644 or RR SB77-5387, Removal of IP Turbine Case Transducer.

(1) Deactivate and tag thrust reverser and associated systems and install thrust reverser locks (Ref. 78-30-00).

(2) On Pilots overhead circuit breaker panel CB1, zone 210, open and tag applicable circuit breaker ENGINE START CONT (E13, E14 or E15).

On FE/SO aft circuit breaker panel CB3, zone 215, open and tag applicable circuit breakers ENG VIB (R2) and ENG VIB LT (R3).

(3) Position working platform in cold stream duct.

(4) Remove turbine section lower fairing 417A for engine No. 1, 427A for engine No. 3 or 437A for engine No. 2 (Ref. 72-03-00).

(5) Remove transducer as follows (Ref. Fig. 402):

(a) On engines without RR SB77-4416, remove locking clip (1).

CAUTION: ENSURE THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE DISCONNECTING.

(b) Unscrew connecting nut (2) or (6) and remove lead assembly (3) or (7) from transducer electrical receptacle.

(c) On engines without RR SB77-5388, remove and discard seal ring.

(c) On engines with RR SB77-5388, remove and discard nickel washer.

(d) Remove bolts and nuts (4) then remove transducer (5).

NOTE: On engines with RR SB77-5322 or RR SB77-5388, note position of locking tab.

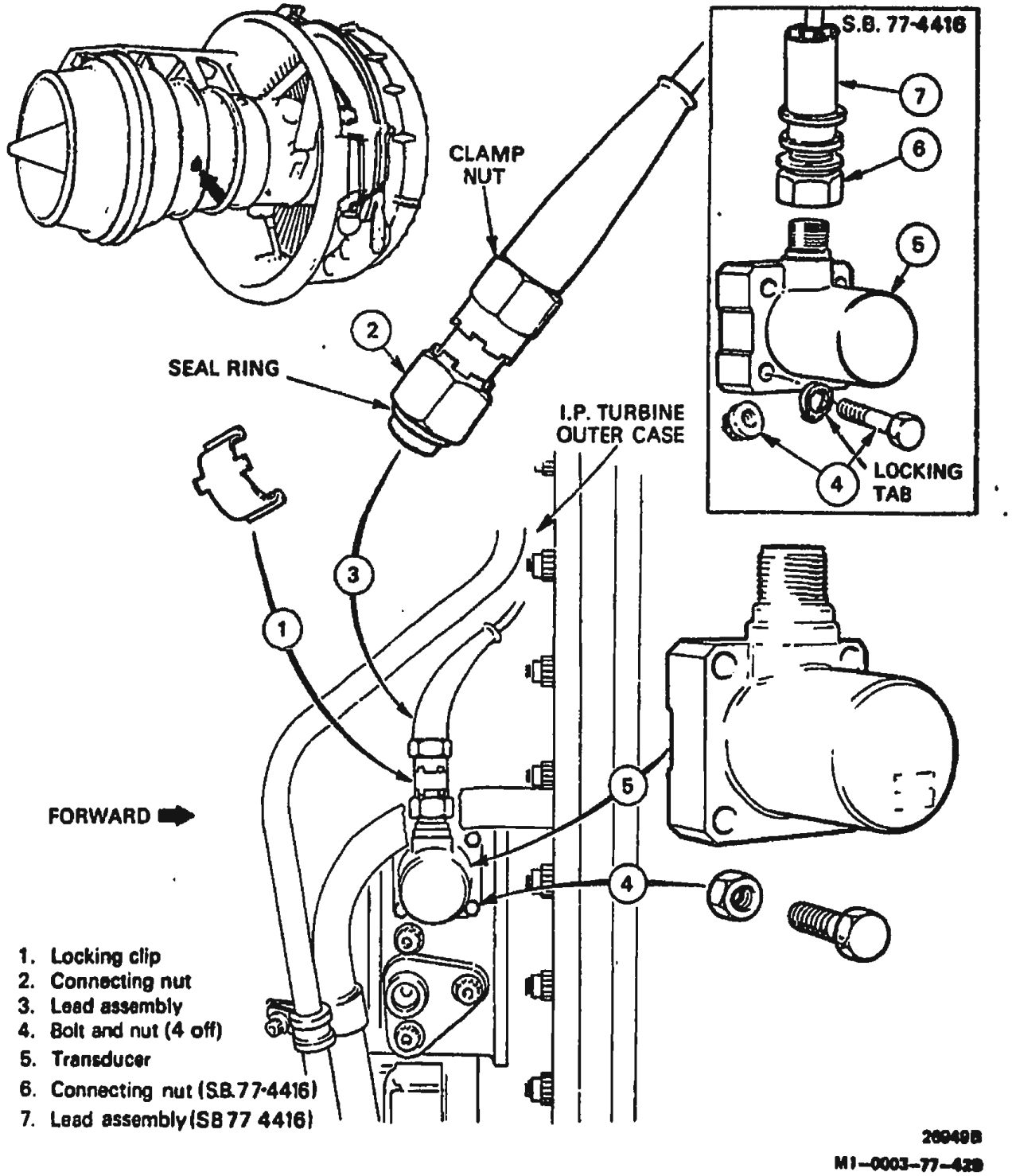
R CAUTION: ACCELEROMETERS FEATURE DELICATE COMPONENTS IN THEIR
R INTERNAL CONSTRUCTION AND MUST THEREFORE BE TREATED
R WITH EXTREME CARE. IF SUBJECTED TO IMPACT, DAMAGE MAY
R RESULT.

F. On Engines Without RR SB77-4644 or RR SB77-5387, Installation of IP Turbine Case Transducer.

(1) Ensure thrust reverser is locked and systems are deactivated and tagged as described in Step 4E(2).

(2) Position working platform in cold stream duct.

(3) On engines without RR SB77-4416, install transducer as follows (Ref. Fig. 402):



IP Turbine Case Transducer
Figure 402

(a) On engines without RR SB77-5388, install transducer (5) on IP turbine case with bolts and nuts (4).

(a) On engines with RR SB77-5388, install transducer (5) on IP turbine case with bolts and nuts (4) and locking tab.

NOTE: Install locking tab on bolt and nut nearest transducer electrical receptacle.

CAUTION: ENSURE A NEW SEAL RING IS IN POSITION AT SHOULDER OF LEAD ASSEMBLY (3).

ENSURE THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID COMTAMINATION BEFORE CONNECTING.

(b) On engines without RR SB77-5388, slide back connecting nut (2), install new seal ring on lead assembly (3) then fully insert lead assembly into transducer electrical receptacle (Ref. 70-02-01).

NOTE: Ensure positive location of key.

CAUTION: ENSURE A NEW NICKEL WASHER IS IN POSITION AT SHOULDER OF LEAD ASSEMBLY (3).

ENSURE THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(b) On engines with RR SB77-5388, slide back connecting nut (2), install a new nickel washer on lead assembly (3) then fully insert lead assembly into transducer electrical receptacle.

NOTE: Ensure positive location of key.

CAUTION: DO NOT TURN CLAMP NUT.

(c) On engines without RR SB77-5388, screw connecting nut (2) onto transducer then torque to 60 lb in. (6.78 Nm).

(c) On engines with RR 77-5388, screw connecting nut (2) onto transducer and torque to 60 lb in. (6.78 Nm). Utilizing locking tab, lock-wire connecting nut.

CAUTION: DO NOT LOOSEN CONNECTING NUT (2) TO ALIGN RECESSES.

DO NOT EXCEED TORQUE OF 100 lb in. (11.31 Nm) ON CONNECTING NUT.

(d) On engines without RR SB77-5388, install locking clip (1). If necessary tighten connecting nut (2) slightly to align recesses in connecting nut and clamp nut with lugs on locking clip.

(e) On engines with RR SB77-3168, lock-wire locking clip (1).

(3) On engines with RR SB77-4416 or RR SB71-5325, install transducer as follows (Ref. Fig. 402):

(a) On engines without RR SB77-5322 or RR SB77-5388, install transducer (5) on IP turbine case with bolts and nuts (4).

(a) On engines with RR SB77-5322 or RR SB77-5388, install transducer (5) on IP turbine case with bolts and nuts (4) and locking tab.

NOTE: Install locking tab on bolt and nut nearest transducer electrical receptacle.

CAUTION: ENSURE THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(b) On engines without RR SB77-5388, slide back connecting nut (6) and fully insert lead assembly (7) into transducer electrical receptacle.

NOTE: Ensure positive location of key.

CAUTION: ENSURE A NEW NICKEL WASHER IS IN POSITION AT SHOULDER OF LEAD ASSEMBLY (7).

ENSURE THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(b) On engines with RR SB77-5388, slide back connecting nut (6), install a new nickel washer on lead assembly (7) then fully insert lead assembly into transducer electrical receptacle.

NOTE: Ensure positive location of key.

(c) On engines without RR SB77-5388 or RR SB77-5322, screw connecting nut (6) onto transducer and torque to 60 lb in. (6.78 Nm). Lock-wire connecting nut to lead assembly (7).

(c) On engines with RR SB77-5388, without RR SB77-5322, screw connecting nut (6) onto transducer and torque to 60 lb in. (6.78 Nm). Utilizing locking tab, lock-wire connecting nut.

(c) On engines with RR SB77-5322,

(i) Apply a thin film of grease to transducer connector threads, screw connecting nut (6) onto transducer and torque 60 to 100 lb in. (6.78 to 11.31 Nm). Wipe off excess grease.

(ii) Using a single length of lock-wire, lock-wire units together in the following sequence:

Locking tab to connecting nut (6).

Connecting nut (6), to connector body and lead assembly (7).

(iii) Using a separate length of lock-wire, lock-wire connector body to lead assembly (7).

(4) Install turbine section lower fairing removed in Step 4E(4).

(5) Remove working platform from cold stream duct.

(6) Unlock and reactivate thrust reverser and associated systems (Ref. 78-30-00).

(7) Remove tags and close circuit breakers opened in Step 4E(2).

G. On Engines Without RR SB72-3310 and RR SB77-4644, Removal of IP Compressor Case Transducer Lead Assembly.

(1) Deactivate and tag thrust reverser and associated systems and install thrust reverser locks (Ref. 78-30-00).

(2) On Pilots overhead circuit breaker panel CB1, zone 210, open and tag applicable circuit breaker ENGINE START CONT (E13, E14 or E15).

On FE/SO aft circuit breaker panel CB3, zone 215, open and tag applicable circuit breakers ENG VIB (R2) and ENG VIB LT (R3).

(3) Position working platform in cold stream duct.

(4) Remove the following access panels (Ref. 72-03-00):

(a) Engines No. 1 or No. 3

Compressor Section Upper LH Fairing 412AL or 422AL.

Compressor Section Upper RH Fairing 412AR or 422AR.

Compressor Section Rear LH Fairing 412FL or 422FL.

Compressor Section Front LH Fairing 412BL or 422BL.

IP/HP Duct RH Access Panel 418AR or 428AR.

(b) Engine No. 2

Compressor Section Upper LH Fairing 432AL.

Compressor Section Upper RH Fairing 432AR.

Compressor Section Rear LH Fairing 432FL.

Compressor Section Front LH Fairing 432BL.

IP/HP Duct RH Access Panel 438AR.

(5) Remove transducer lead assembly as follows (Ref. Fig. 403):

(a) Remove nuts (1), junction box cover (2) and packing piece (3).

(b) Remove nuts (4), lift cable leads from terminal posts and disconnect connector (5).

(c) On engines without RR SB72-3198, remove nuts and bolts (6) then remove insert halves (7) from seal housing (8).

NOTE: Note lead assembly routing through insert halves for subsequent installation.

(c) On engines with RR SB72-3198, remove bolts (6), then remove two piece seal housing (8), insert halves (7) and two piece cover (9).

NOTE: Note lead assembly routing through insert halves for subsequent installation.

(d) Remove clips (10) through (17).

NOTE: Retain clips for installation with new lead assembly.

(e) On engines without RR SB72-3198, uncoil lead assembly in interservices fairing and withdraw through seal housing (8), cover (9) and opening in fairing floor.

(e) On engines with RR SB72-3198, uncoil lead assembly in interservices fairing and withdraw through opening in fairing floor.

(f) On engines without RR SB77-4416, remove locking clip (1) (Ref. Fig. 401).

CAUTION: ENSURE THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE DISCONNECTING.

(g) Unscrew connecting nut (2) or (6) and remove lead assembly (3) or (7) from transducer electrical receptacle (Ref. Fig. 401).

(h) On engines without RR SB77-5388, remove and discard seal ring.

(h) On engines with RR SB77-5388, remove and discard nickel washer.

G. On Engines Without RR SB72-3310, With RR SB77-4644, Removal of IP Compressor Case Transducer Lead Assembly.

NOTE: The lead assembly removal procedure at both junction boxes is identical and the lead assembly removal procedure at both transducers is identical.

(1) Deactivate and tag thrust reverser and associated systems and install thrust reverser locks (Ref. 78-30-00).

(2) On Pilots overhead circuit breaker panel CB1, zone 210, open and tag applicable circuit breaker ENGINE START CONT (E13, E14 or E15).

On FE/SO aft circuit breaker panel CB3, zone 215, open and tag applicable circuit breakers ENG VIB (R2) and ENG VIB LT (R3).

(3) Position working platform in cold stream duct.

(4) Remove the following access panels (Ref. 72-03-00):

(a) Engines No. 1 or No. 3

Compressor Section Upper LH Fairing 412AL or 422AL.

Compressor Section Upper RH Fairing 412AR or 422AR.

Compressor Section Rear LH Fairing 412FL or 422FL.

Compressor Section Front LH Fairing 412BL or 422BL.

IP/HP Duct RH Access Panel 418AR or 428AR.

(b) Engine No. 2

Compressor Section Upper LH Fairing 432AL.

Compressor Section Upper RH Fairing 432AR.

Compressor Section Rear LH Fairing 432FL.

Compressor Section Front LH Fairing 432BL.

IP/HP Duct RH Access Panel 438AR.

(5) Remove transducer lead assembly as follows (Ref. Fig. 403):

(a) Remove nuts (1), junction box cover (2) and packing piece (3).

(b) Remove nuts (4) and lift cable assembly leads from terminal posts then disconnect connector (5).

(c) On engines without RR SB72-3198, remove nuts and bolts (6) then remove insert halves (7) from seal housing (8).

NOTE: Note cable routing through insert halves for subsequent installation.

(c) On engines with RR SB72-3198, remove bolts (6) then remove two piece seal housing (8), insert halves (7) and two piece cover (9).

NOTE: Note cable routing through insert halves for subsequent installation.

(d) Remove clips (1) through (9) and retain for installation with new lead assembly. Release clips (10) and (11) and separate lead assembly from loom [Ref. Fig. 404 (Sheet 1)].

NOTE: Leave clips (10) and (11) attached to loom.

(e) Remove clips (20) and (21) and retain for installation on new lead assembly. Release clips (12) through (19) and separate lead assembly from loom [Ref. Fig. 404 (Sheet 3)].

NOTE: Leave clips (12) through (19) attached to loom.

(f) Remove lacing tape and separate lead assembly from loom [Ref. Fig. 404 (Sheets 1 and 3)].

(g) On engines without RR SB72-3198, withdraw lead assembly through seal housing (8), cover (9) and opening in interservices fairing floor (Ref. Fig. 403).

(g) On engines with RR SB72-3198, withdraw lead assembly through opening in interservices fairing floor.

(h) On engines without RR SB77-4416, remove locking clip (1) (Ref. Fig. 401).

CAUTION: ENSURE THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE DISCONNECTING.

(i) Unscrew connecting nut (2) or (6) and withdraw lead assembly (3) or (7) from transducer electrical receptacle (Ref. Fig. 401).

(j) On engines without RR SB77-5388, remove and discard seal ring.

(j) On engines with RR SB77-5388, remove and discard nickel washer.

G. On Engines With RR SB72-3310, Without RR SB77-4644, Removal of IP Compressor Case Transducer Lead Assembly.

(1) Deactivate and tag thrust reverser and associated systems and install thrust reverser locks (Ref. 78-30-00).

(2) On Pilots overhead circuit breaker panel, CB1, zone 210, open and tag applicable circuit breaker ENGINE START CONT (E13, E14 or E15).

On FE/SO aft circuit breaker panel CB3, zone 215, open and tag applicable circuit breakers ENG VIB (R2) and ENG VIB LT (R3).

(3) Position working platform in cold stream duct.

(4) Remove the following access panels (Ref. 72-03-00):

(a) Engine No. 1 and No. 3

Compressor Section Upper RH Fairing 412AR or 422AR.

Compressor Section Rear RH Fairing 412FR or 422FR.

RH Interservices Access Panel 418BR or 428BR.

(b) Engine No. 2

Compressor Section Upper RH Fairing 432AR.

Compressor Section Rear RH Fairing 432FR.

RH Interservices Access Panel 438BR.

(5) Remove transducer lead assembly as follows (Ref. Fig. 403):

(a) Remove nuts (1), junction box cover (2) and remove packing piece (3).

(b) Remove nuts (4), lift cable assembly leads from terminal posts and disconnect connector (5).

(c) On engines without RR SB72-3198, remove nuts and bolts (6) then remove insert halves (7) from seal housing (8).

NOTE: Note cable routing through insert halves for subsequent installation.

(c) On engines with RR SB72-3198, remove bolts (6) then remove two piece seal housing (8), insert halves (7) and two piece cover (9).

NOTE: Note cable routing through insert halves for subsequent installation.

(d) On engines without RR SB72-3198, withdraw transducer lead assembly through seal housing (8), cover (9) and opening in interservices fairing floor.

(d) On engines with RR SB72-3198, withdraw transducer lead assembly through opening in interservices fairing floor.

(e) On engines without RR SB77-4416, remove locking clip (1) (Ref. Fig. 401).

CAUTION: ENSURE ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE DISCONNECTING.

(f) Unscrew connecting nut (2) or (6) and withdraw lead assembly (3) or (7) from transducer electrical receptacle.

(g) On engines without RR SB77-5388, remove and discard seal ring.

(g) On engines with RR SB77-5388, remove and discard nickel washer.

(h) Release clips (10) through (15).

NOTE: Leave clips attached to loom.

(i) Remove lacing tape and separate transducer lead assembly from loom and clips.

G. On Engines With RR SB72-3310 and RR SB77-4644, Remove IP Compressor Case Transducer Lead Assembly.

NOTE: The lead assembly removal procedure at both junction boxes is identical.

The lead assembly removal procedure at both transducers is also identical.

(1) Deactivate and tag thrust reverser and associated systems and install thrust reverser locks (Ref. 78-30-00).

(2) On Pilots overhead circuit breaker panel, CB1, zone 210, open and tag applicable circuit breaker ENGINE START CONT (E13, E14 or E15).

On FE/SO aft circuit breaker panel CB3, zone 215, open and tag applicable circuit breakers ENG VIB (R2) and ENG VIB LT (R3).

(3) Position working platform in cold stream duct.

(4) Remove the following access panels (Ref. 72-03-00):

(a) Engine No. 1 or No. 3

Compressor Section Upper RH Fairing 412AR or 422AR.

Compressor Section Rear RH Fairing 412FR or 422FR.

RH Interservices Access Panel 418BR or 428BR.

(b) Engine No. 2

Compressor Section Upper RH Fairing 432AR.

Compressor Section Rear RH Fairing 432FR.

RH Interservices Access Panel 438BR.

(5) Remove transducer lead assembly as follows (Ref. Fig. 403):

(a) Remove nuts (1), junction box cover (2) and withdraw packing piece (3).

(b) Remove nuts (4), lift cable assembly leads from terminal posts then disconnect connector (5).

(c) On engines without RR SB72-3198, remove nuts and bolts (6) then remove insert halves (7) from seal housing (8).

NOTE: Note cable routing through insert halves for subsequent installation.

(c) On engines with RR SB72-3198, remove bolts (6) then remove two piece seal

housing (8), two piece cover (9) and insert halves (7).

NOTE: Note cable routing through insert halves for subsequent installation.

(d) Remove clips (5) through (7) and retain for installation with new lead assembly. Release clips (1) through (4), (8) through (12) and separate lead assembly from loom [Ref. Fig. 404 (Sheet 2)].

NOTE: Leave clips (1) through (4) and (8) through (12) attached to loom.

(e) Remove clips (20) and (21) and retain for installation with new lead assembly. Release clips (12) through (19) and separate lead assembly from loom [Ref. Fig. 404 (Sheet 3)].

NOTE: Leave clips (12) through (19) attached to loom.

(f) Remove lacing tape and separate lead assembly from loom [Ref. Fig. 404 (Sheet 2) and (Sheet 3)].

(g) On engines without RR SB72-3198, withdraw lead assembly from seal housing (8), cover (9) and opening in interservices fairing floor (Ref. Fig. 403).

(g) On engines with RR SB72-3198, withdraw lead assembly from opening in interservices fairing floor (Ref. Fig. 403).

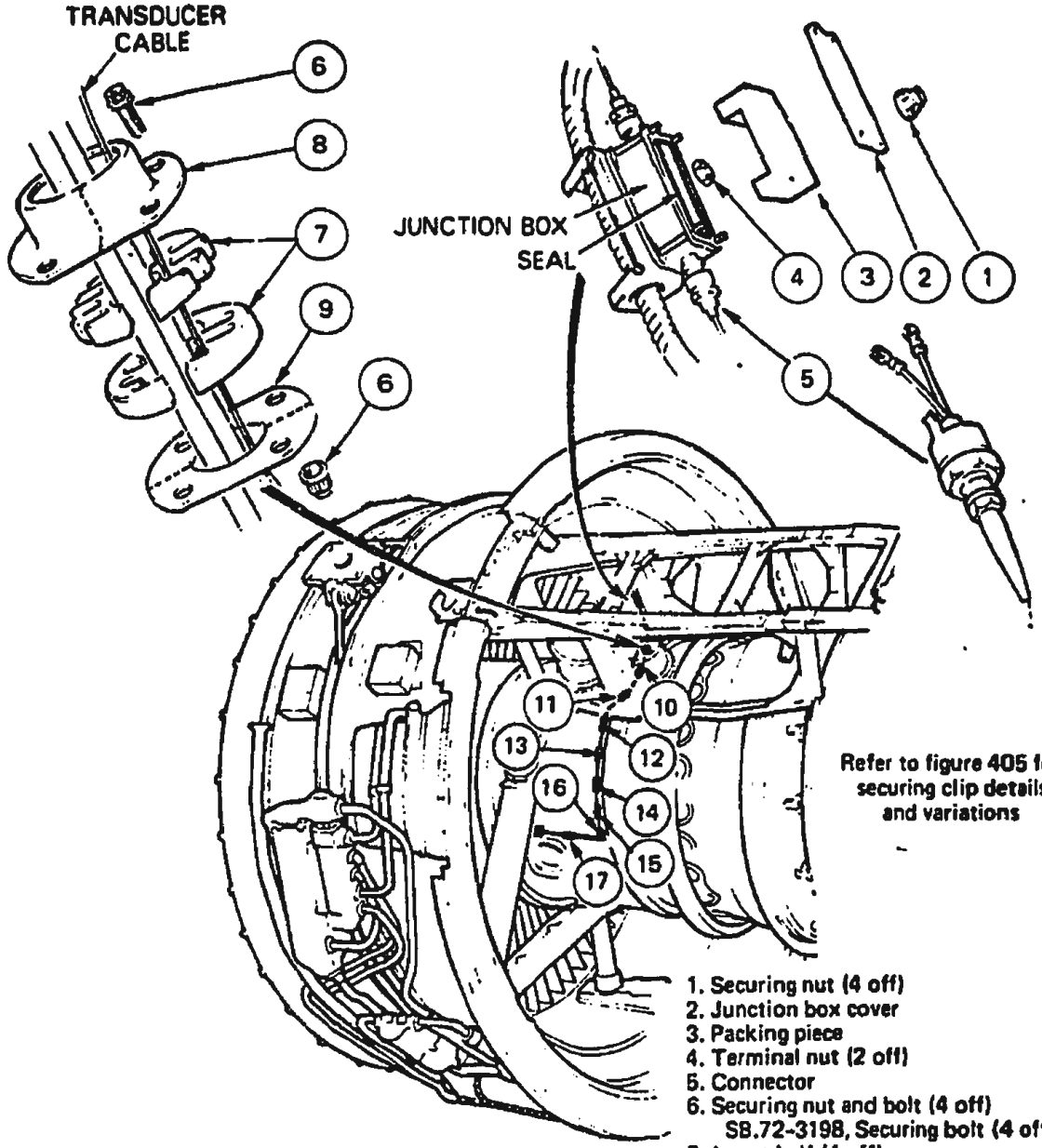
(h) On engines with/without RR SB77-4644, without RR SB77-5506 proceed as follows (Ref. Fig. 401):

(i) On engines without RR SB77-4416, remove locking clip (1).

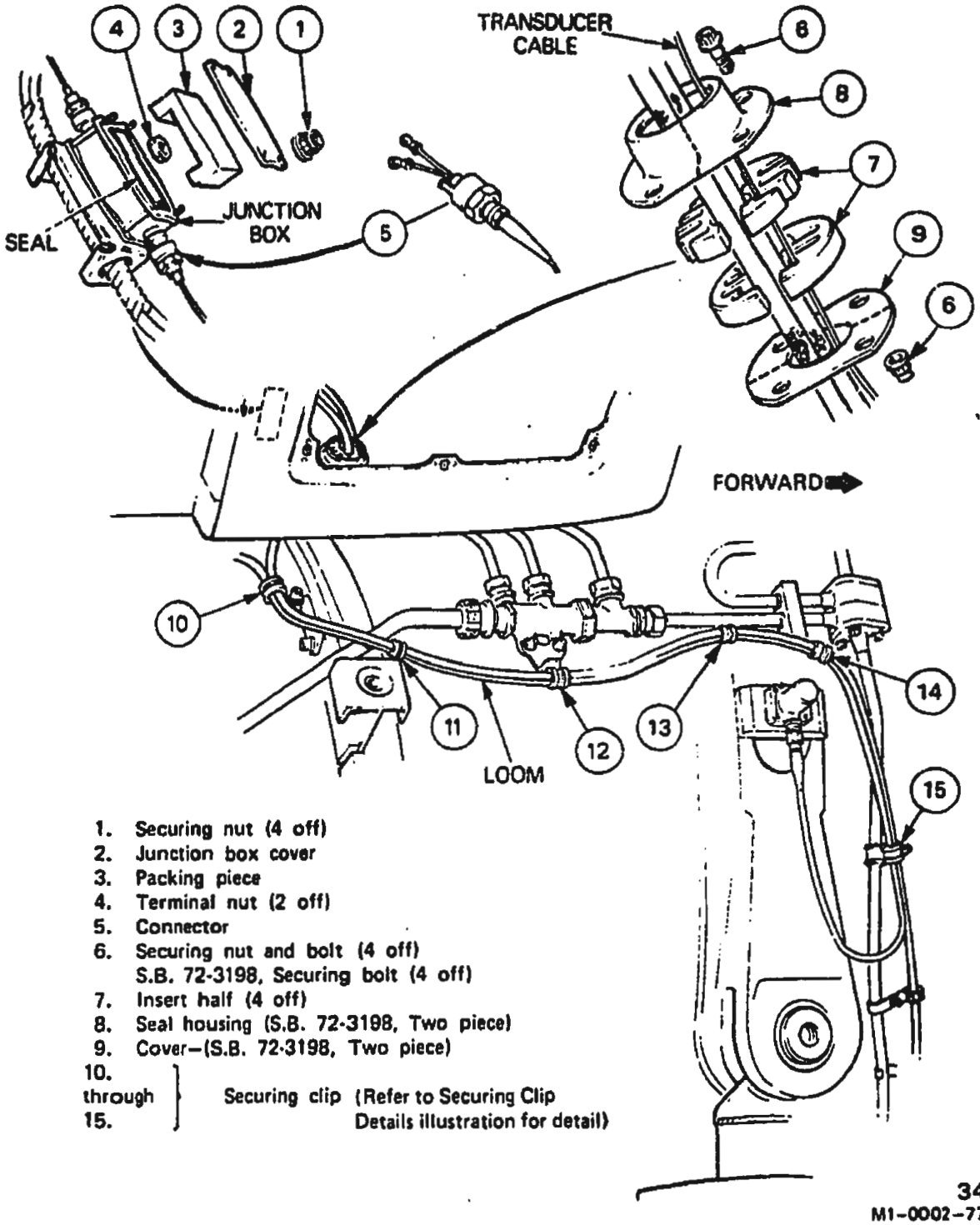
CAUTION: ENSURE ELECTRICAL IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE DISCONNECTING.

(iii) Unscrew connecting nut (2) or (6) and withdraw lead assembly (3) or (7) from transducer electrical receptacle.

(iii) On engines without RR SB77-5388, remove and discard seal ring.


TRANSDUCER CABLE
JUNCTION BOX SEAL
FORWARD
Refer to figure 405 for securing clip details and variations
1. Securing nut (4 off)
2. Junction box cover
3. Packing piece
4. Terminal nut (2 off)
5. Connector
6. Securing nut and bolt (4 off)
SB.72-3198, Securing bolt (4 off)
7. Insert half (4 off)
8. Seal housing (SB.72-3198, Two piece)
9. Cover (SB.72-3198, Two piece)
10. through 17. Securing clip
34681
M1-0002-77-438

IP Compressor Case Transducer Lead Assembly
Figure 403



1. Securing nut (4 off)
2. Junction box cover
3. Packing piece
4. Terminal nut (2 off)
5. Connector
6. Securing nut and bolt (4 off)
   S.B. 72-3198, Securing bolt (4 off)
7. Insert half (4 off)
8. Seal housing (S.B. 72-3198, Two piece)
9. Cover–(S.B. 72-3198, Two piece)
10. through 15. Securing clip (Refer to Securing Clip Details illustration for detail)

34538
M1-0002-77-442

IP Compressor Case Transducer Lead Assembly
Figure 403

(iv) On engines with RR SB77-5388, remove and discard nickel washer.

(i) On engines with RR SB77-4644 and RR SB77-5506 proceed as follows:

(i) Remove clips (5) through (7) and retain for use with new lead assembly [Ref. Fig. 404 (Sheet 4)].

(ii) Release clips (1) through (4) and (8) through (11) and separate lead assembly from loom. Leave clips attached to loom.

(iii) Remove clip (9) and retain for installation with new lead assembly [Ref. Fig. 404 (Sheet 5)].

(iv) Release clips (1) through (8) and separate lead assembly from loom. Leave clips attached to loom.

(v) Remove lacing tape and separate lead assembly from loom [Ref. Fig. 404 (Sheets 2 and 3)].

(vi) On engines without RR SB72-3198, withdraw lead assembly through seal housing (8), cover (9), and aperture in interservices fairing floor (Ref. Fig. 403).

(vi) On engines with RR SB72-3198, withdraw lead assembly through aperature in interservices fairing floor.

CAUTION: ENSURE ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE DISCONNECTING.

(vii) Unscrew connector nut (1) and remove lead assembly (6) from transducer electrical receptacles. Remove and discard nickel washer (2) [Ref. Fig. 401].

H. On engines without RR SB72-3310 and RR SB77-4644, Installation of IP Compressor Case Transducer Lead Assembly.

(1) Ensure that thrust reverser is locked and systems are deactivated and tagged as described in Step 4G(2).

(2) Position working platform in cold stream duct.

(3) Install transducer lead assembly as follows (Ref. Fig. 403):

(a) Position clips (10) through (17) on new lead assembly.

(b) On engines without RR SB72-3198, pass lead assembly through opening in interservices fairing floor, cover (9) and seal housing (8), then temporarily secure.

(b) On engines with RR SB72-3198, pass lead assembly through opening in interservices fairing floor.

(c) Position and secure clips (10) through (17).

CR CAUTION: ENSURE CORRECT ROUTING OF LEAD ASSEMBLY
CR THROUGH INSERT HALVES [REF. 4.G.(5)(c)],
CR OTHERWISE CABLE WILL CHAFE ON EDGE OF SEAL
CR HOUSING OR COVER.

(d) On engines without RR SB72-3198, position insert halves (7) in seal housing (8).

R NOTE: Install cover (9) and seal housing (8) on interservices fairing floor with nuts and bolts (6).

CR CAUTION: ENSURE CORRECT ROUTING OF LEAD ASSEMBLY
CR THROUGH INSERT HALVES [REF. 4.G.(5)(c)],
CR OTHERWISE CABLE WILL CHAFE ON EDGE OF SEAL
CR HOUSING OR COVER.

(d) On engines with RR SB72-3198, install two piece cover (9), insert halves (7) and two piece seal housing (8) on interservices fairing floor with bolts (6).

(c) Form excess lead assembly into a coil and secure in interservices fairing.

(f) Insert harness leads through junction box connector. Install harness leads on junction box terminal posts with nuts (4).

(g) Screw connector (5) onto junction box connector and secure.

(h) Position seal in junction box recess and install packing piece (3) (legs first) into junction box. Install cover (2) and secure with nuts (1).

NOTE: Replace seal if cracked or frayed.

(4) On engines without RR SB77-4416, connect transducer lead assembly as follows (Ref. Fig. 401):

CAUTION: ENSURE A NEW SEAL RING IS IN POSITION AT SHOULDER OF LEAD ASSEMBLY (3).

ENSURE THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(a) On engines without RR SB77-5388, slide back connecting nut (2), install new seal ring on lead assembly (3) then fully insert lead assembly into transducer electrical receptacle (Ref. 70-02-01).

NOTE: Ensure positive location of key.

CAUTION: ENSURE A NEW NICKEL WASHER IS IN POSITION AT SHOULDER OF LEAD ASSEMBLY (3).

ENSURE THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(a) On engines with RR SB77-5388, slide back connecting nut (2), install a new nickel washer on lead assembly (3) then fully insert lead assembly into transducer electrical receptacle.

NOTE: Ensure positive location of key.

CAUTION: DO NOT TURN CLAMP NUT.

(b) On engines without RR SB77-5388, screw connecting nut (2) onto transducer then torque to 60 lb in. (6.78 Nm).

(b) On engines with RR SB77-5388, screw connecting nut (2) onto transducer and torque to 60 lb in. (6.78 Nm). Utilizing locking tab lock-wire connecting nut.

CAUTION: DO NOT LOOSEN CONNECTING NUT (2) TO ALIGN RECESSES.

DO NOT EXCEED 100 LB IN. (11.31 Nm) TORQUE ON CONNECTING NUT.

(c) On engines without RR SB77-5388, install locking clip (1). If necessary tighten connecting nut (2) slightly to align recesses in connecting nut and clamp nut with lugs on locking clip.

(c) On engines with RR SB77-3168, lock-wire locking clip (1).

(4) On engines with RR SB77-4416 or RR SB71-5325, connect transducer lead assembly as follows (Ref. Fig. 401):

CAUTION: ENSURE ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(a) On engines without RR SB77-5388, slide back connecting nut (6) and fully insert lead assembly (7) into transducer electrical receptacle.

NOTE: Ensure positive location of key.

CAUTION: ENSURE A NEW NICKEL WASHER IS IN POSITION AT SHOULDER OF LEAD ASSEMBLY (7).

ENSURE THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(a) On engines with RR SB77-5388, slide back connecting nut (6), install a new nickel washer on lead assembly (7) then fully insert lead assembly into transducer electrical receptacle.

NOTE: Ensure positive location of key.

(b) On engines without RR SB77-5322, screw connecting nut (6) onto transducer. Torque to 60 lb in. (6.78 Nm) and lock-wire.

(b) On engines with RR SB77-5322

(i) Apply a thin film of grease to transducer connector threads. Screw connecting nut (6) onto transducer and torque 60 to 100 lb in. (6.78 to 11.31 Nm). Wipe off excess grease.

(ii) Using a single length of lock-wire, lock-wire units together in the following sequence:

Locking tab, to connector nut (6).

Connector nut (6), to connector body and lead assembly (7).

(iii) Using a separate length of lock-wire, lock-wire connector body to lead assembly (7).

CR CR CR CR CR CR CAUTION: PRIOR TO INSTALLING ACCESS PANELS, ASSURE THAT THRUST REVERSER FLEXIBLE DRIVE SUPPORT (78-31-08 FIG. 401 (SHEET 2) ITEM 3) IS PROPERLY SECURED. DAMAGE TO LEAD ASSEMBLY MAY OCCUR IF FLEXIBLE DRIVE IS NOT RESTRAINED AND IS ALLOWED TO WHIP DURING REVERSER OPERATION.

(5) Install access panels removed in Step 4G(4) (Ref. 72-03-00).

(6) Remove working platform from cold stream duct.

(7) Unlock and reactivate thrust reverser and associated systems (Ref. 78-30-00).

(8) Remove tags and close circuit breakers opened in Step 4G(2).

H. On Engines Without RR SB72-3310, With RR SB77-4644, Installation of IP Compresssor Case Transducer Lead Assembly.

NOTE: The lead assembly installation procedure at both junction boxes is identical.

The lead assembly installation procedure at both transducers is also identical.

(1) Ensure thrust reverser is locked and systems are deactivated and tagged as described in Step 4G(2).

(2) Position working platform in cold stream duct.

(3) Install transducer lead assembly as follows.

(a) On engines without RR SB72-3198, pass lead assembly through opening in interservices fairing floor, cover (9), seal housing (8) and temporarily secure (Ref. Fig. 403).

(a) On engines with RR SB72-3198, pass lead assembly through opening in interservices fairing floor (Ref. Fig. 403).

(b) Position new lead assembly under clips (10) and (11) on loom then secure clips. Position and secure clips (1) through (9) [Ref. Fig. 404 (Sheet 1)].

(c) Position new lead assembly under clips (12) through (19) on loom then secure clips. Position and secure clips (20) and (21) [Ref. Fig. 404 (Sheet 3)].

CR CAUTION: ENSURE CORRECT ROUTING OF LEAD ASSEMBLY
CR THROUGH INSERT HALVES [REF. 4.G.(5)(c)],
CR OTHERWISE CABLE WILL CHAFE ON EDGE OF SEAL
CR HOUSING OR COVER.

(d) On engines without RR SB72-3198, install insert halves (7) in seal housing (8). Position cover (9) and seal housing (8) on interservices floor with nuts and bolts (6) (Ref. Fig. 403).

CR CAUTION: ENSURE CORRECT ROUTING OF LEAD ASSEMBLY
CR THROUGH INSERT HALVES [REF. 4.G.(5)(c)],
CR OTHERWISE CABLE WILL CHAFE ON EDGE OF SEAL
CR HOUSING OR COVER.

(d) On engines with RR SB72-3198, position insert halves (7), two piece seal housing (8) and two piece cover (9) on interservices fairing floor with securing bolts (6) (Ref. Fig. 403).

(e) Insert harness leads through junction box connector. Install harness leads on junction box terminal posts with nuts (4) (Ref. Fig. 403).

(f) Screw connector (5) onto junction box connector and secure.

(g) Position seal in junction box recess and install packing piece (3) (legs first) into junction box. Install cover (2) and secure with nuts (1).

NOTE: Replace seal if cracked or frayed.

(4) On engines without RR SB77-4416, connect transducer lead assembly as follows (Ref. Fig. 401):

CAUTION: ENSURE A NEW SEAL RING IS IN POSITION AT SHOULDER OF LEAD ASSEMBLY (3).

ENSURE THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(a) On engines without RR SB77-5388, slide back connecting nut (2), install new seal ring on lead assembly (3) then fully insert lead assembly into transducer electrical receptacle (Ref. 70-02-01).

NOTE: Ensure positive location of key.

CAUTION: ENSURE A NEW NICKEL WASHER IS IN POSITION AT SHOULDER OF LEAD ASSEMBLY (3).

ENSURE THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(a) On engines with RR SB77-5388, slide back connecting nut (2), install a new nickel washer on lead assembly (3) then fully insert lead assembly into transducer electrical receptacle.

NOTE: Ensure positive location of key.

CAUTION: DO NOT TURN CLAMP NUT.

(b) On engines without RR SB77-5388, screw connecting nut (2) onto transducer then torque to 60 lb in. (6.78 Nm).

(b) On engines with RR SB77-5388, screw connecting nut (2) onto transducer and torque to 60 lb in. (6.78 Nm). Utilizing locking tab, lock-wire connecting nut.

CAUTION: DO NOT LOOSEN CONNECTING NUT (2), TO ALIGN RECESSES.

DO NOT EXCEED 100LB IN. (11.31 Nm) TORQUE ON CONNECTING NUT.

(c) On engines without RR SB77-5388, install locking clip (1). If necessary tighten connecting nut (2) slightly to align recesses in connecting nut and clamp nut with lugs on locking clip.

(c) On engines with RR SB77-3168, lock-wire locking clip (1).

(4) On engines with RR SB77-4416 or RR SB71-5325, connect transducer lead assembly as follows (Ref. Fig. 401):

CAUTION: ENSURE ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(a) On engines without RR SB77-5388, slide back connecting nut (6) and fully insert lead assembly (7) into transducer electrical receptacle.

NOTE: Ensure positive location key.

CAUTION: ENSURE A NEW NICKEL WASHER IS IN POSITION AT SHOULDER OF LEAD ASSEMBLY (7).

ENSURE THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(a) On engines with RR SB77-5388, slide back connecting nut (6), install a new nickel washer on lead assembly (7) then fully insert lead assembly into transducer electrical receptacle.

NOTE: Ensure positive location of key.

(b) On engines without RR SB77-5322, screw connecting nut (6) onto transducer, torque to 60 lb in. (6.78 Nm) and lock-wire.

(b) On engines with RR SB77-5322

(i) Apply a thin film of grease to transducer connector threads. Screw connecting nut (6) onto transducer and torque 60 to 100 lb in. (6.78 to 11.31 Nm). Wipe off excess grease.

(ii) Using a single length of lock-wire, lock-wire units together in the following sequence:

Locking tab, to connector nut (6).

Connector nut (6), to connector body and lead assembly (7).

(iii) Using a separate length of lock-wire, lock-wire connector body to lead assembly (7).

CR CR CR CR CR CR CAUTION: PRIOR TO INSTALLING ACCESS PANELS, ASSURE THAT THRUST REVERSER FLEXIBLE DRIVE SUPPORT (78-31-08 FIG. 401 (SHEET 2) ITEM 3) IS PROPERLY SECURED. DAMAGE TO LEAD ASSEMBLY MAY OCCUR IF FLEXIBLE DRIVE IS NOT RESTRAINED AND IS ALLOWED TO WHIP DURING REVERSER OPERATION.

(5) Install access panels removed in Step 4G(4) (Ref. 72-03-00).

(b) Remove working platform from cold stream duct.

(7) Unlock and reactivate thrust reverser and associated systems (Ref. 78-30-00).

(8) Remove tags and close circuit breakers opened in Step 4G(2).

H. On Engines With RR SB72-3310 and Without RR SB77-4644, Installation of IP Compressor Case Transducer Lead Assembly.

(1) Ensure thrust reverser is locked and systems are deactivated and tagged as described in Step 4G(2).

(2) Ensure working platform is positioned in cold stream duct.

(3) Position new lead assembly under clips (10) through (15) on loom (Ref. Fig. 403).

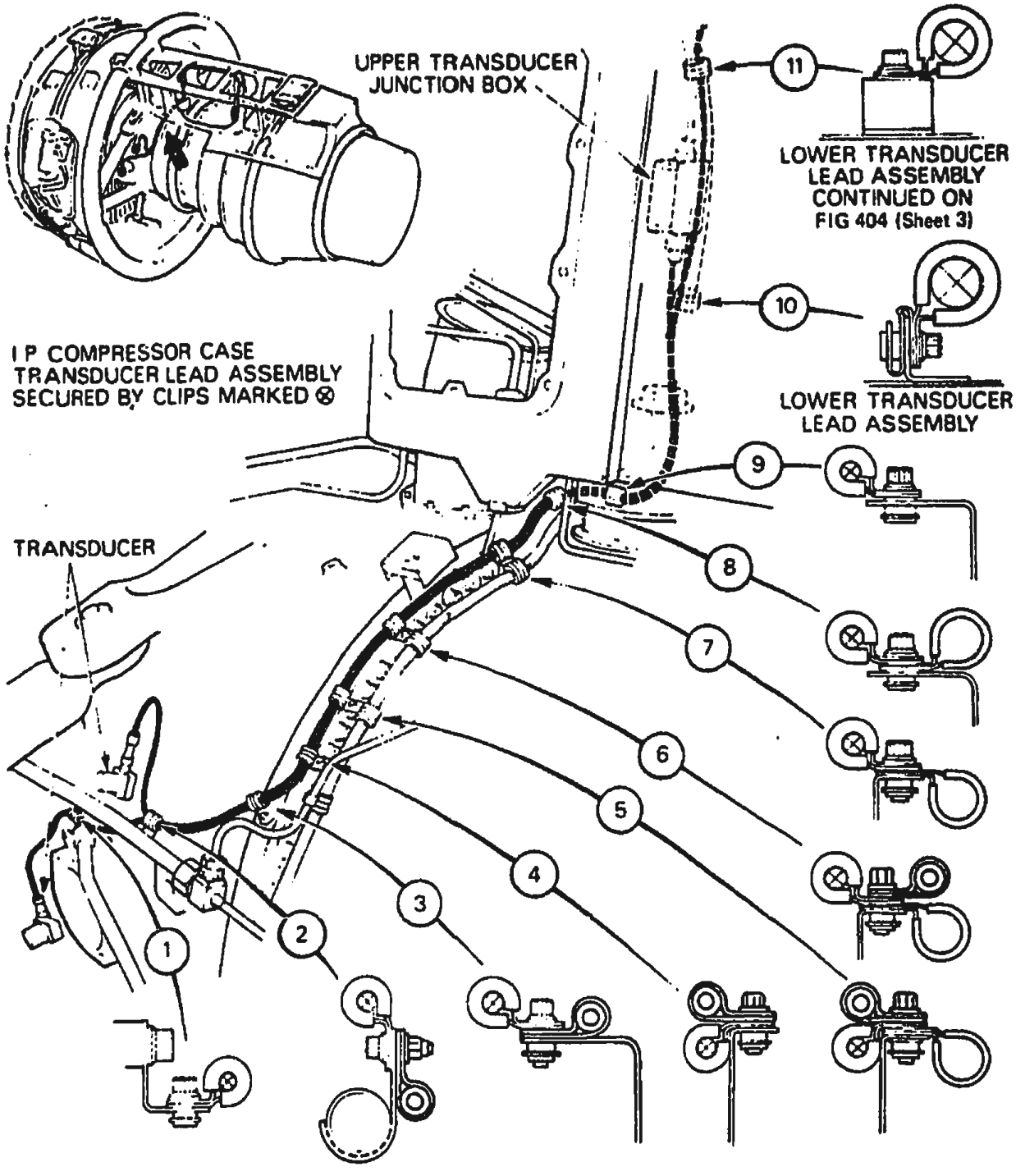
(4) On engines without RR SB77-4416, connect transducer lead assembly as follows (Ref. Fig. 401).

CAUTION: ENSURE A NEW SEAL RING IS IN POSITION AT SHOULDER OF LEAD ASSEMBLY (3).

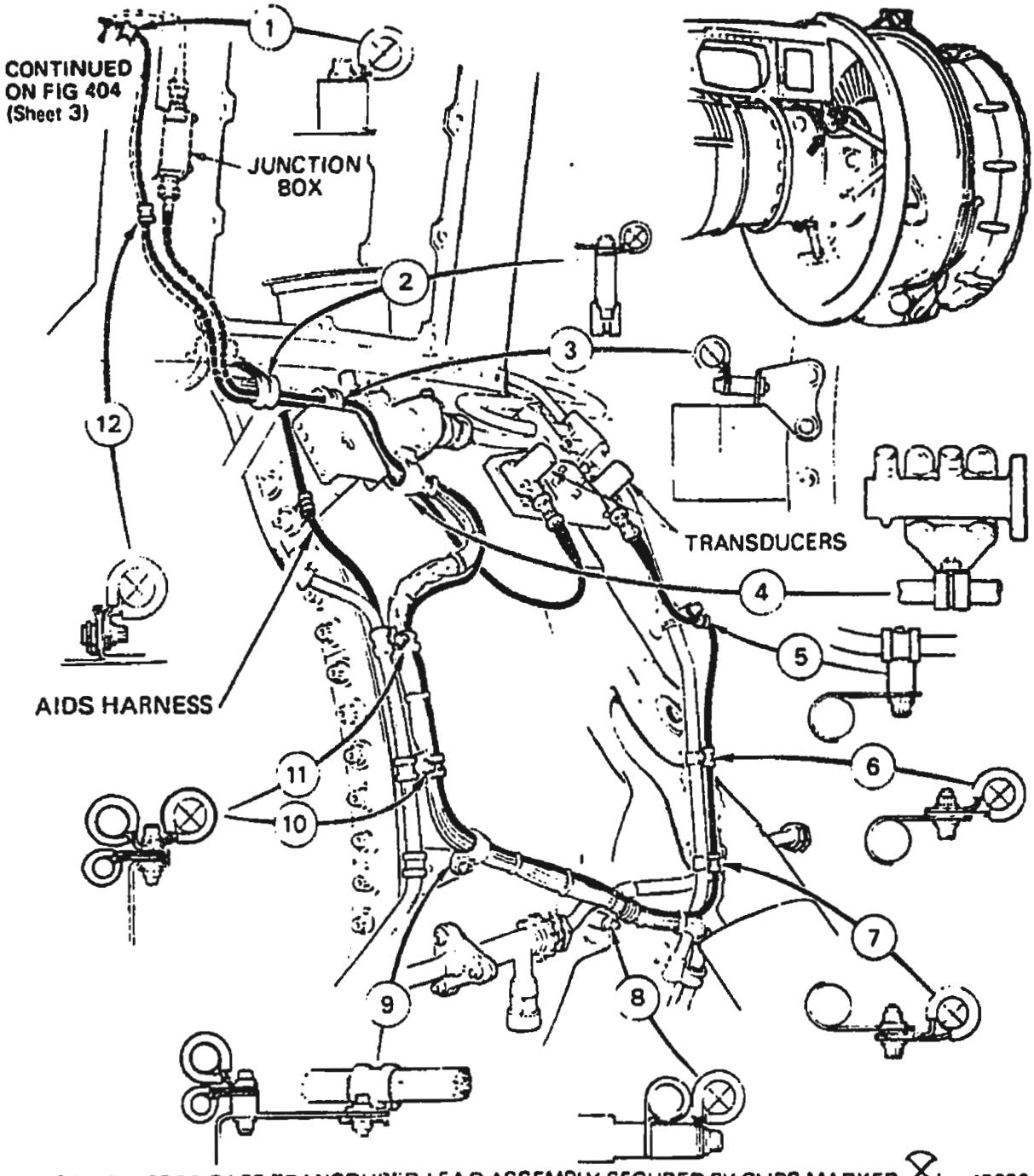
ENSURE THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(a) On engines without RR SB77-5388, slide back connecting nut (2), install new seal ring on lead assembly (3), then fully insert lead assembly into transducer electrical receptacle (Ref. 70-02-01).

NOTE: Ensure positive location of key.



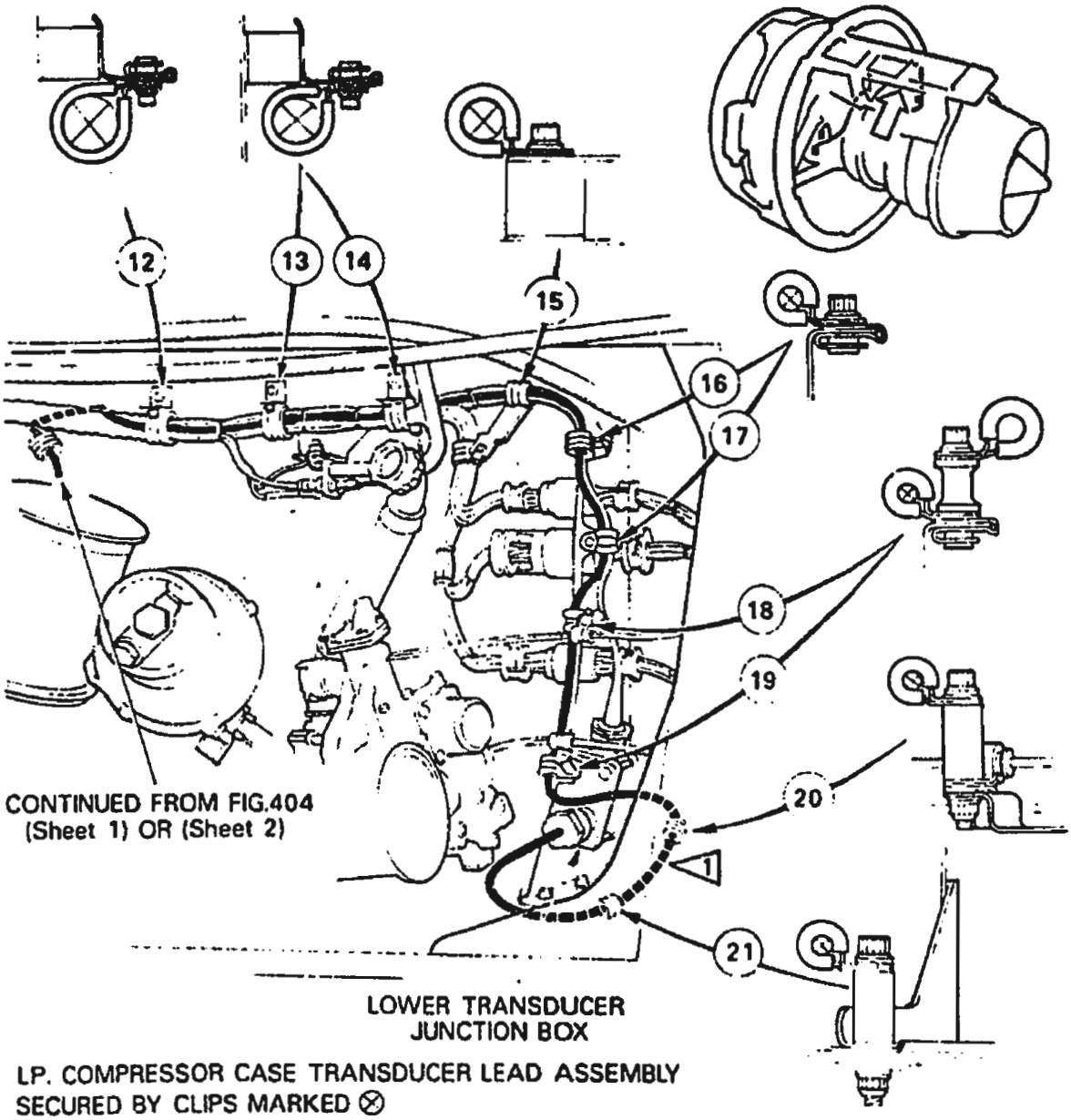
IP Compressor Case Transducer Lead Securing Clips
Figure 404 (Sheet 1)



IP COMPRESSOR CASE TRANSDUCER LEAD ASSEMBLY SECURED BY CLIPS MARKED ⊗ 45336

M1-0001-77-215

IP Compressor Case Transducer Lead Securing Clips
Figure 404 (Sheet 2)



LP. COMPRESSOR CASE TRANSDUCER LEAD ASSEMBLY SECURED BY CLIPS MARKED ⊗

1 THE AFT AVM CABLE SHOULD COME STRAIGHT OUT OF THE AFT J-BOX AND BE ROUTED BETWEEN THE PNEUMATIC LINES. THE LOOP SHOULD BE CLAMPED AT THE UPPER CORNER OF THE J-BOX. DO NOT ROUTE WITH A SHARP BEND TO CLEAR THE LINES.

C2688

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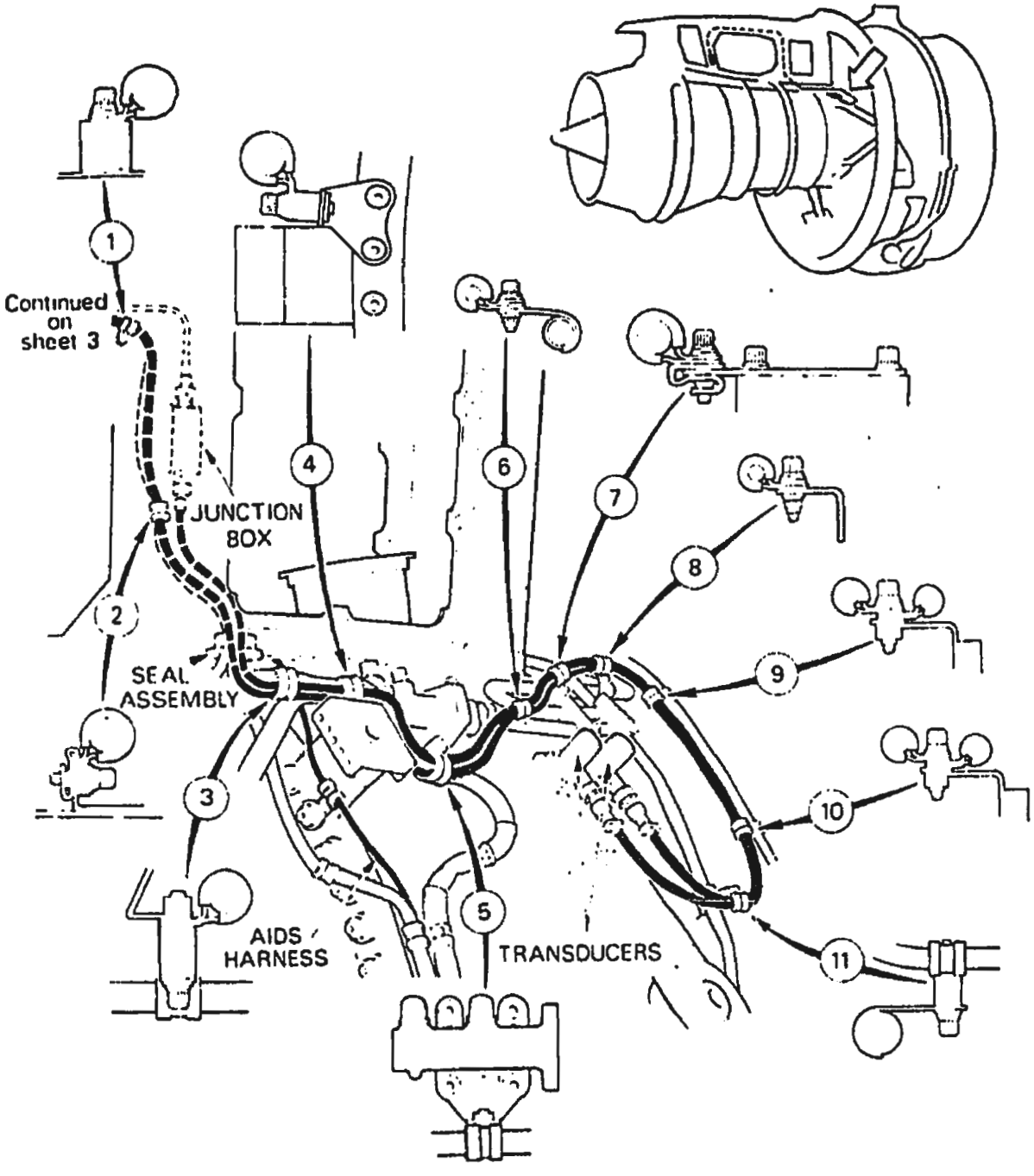
CR IP Compressor Case Transducer Lead Securing Clips
CR Figure 404 (Sheet 3)

EFFECTIVITY: WITHOUT RR SB72-3310,
WITH RR SB77-4644

0018



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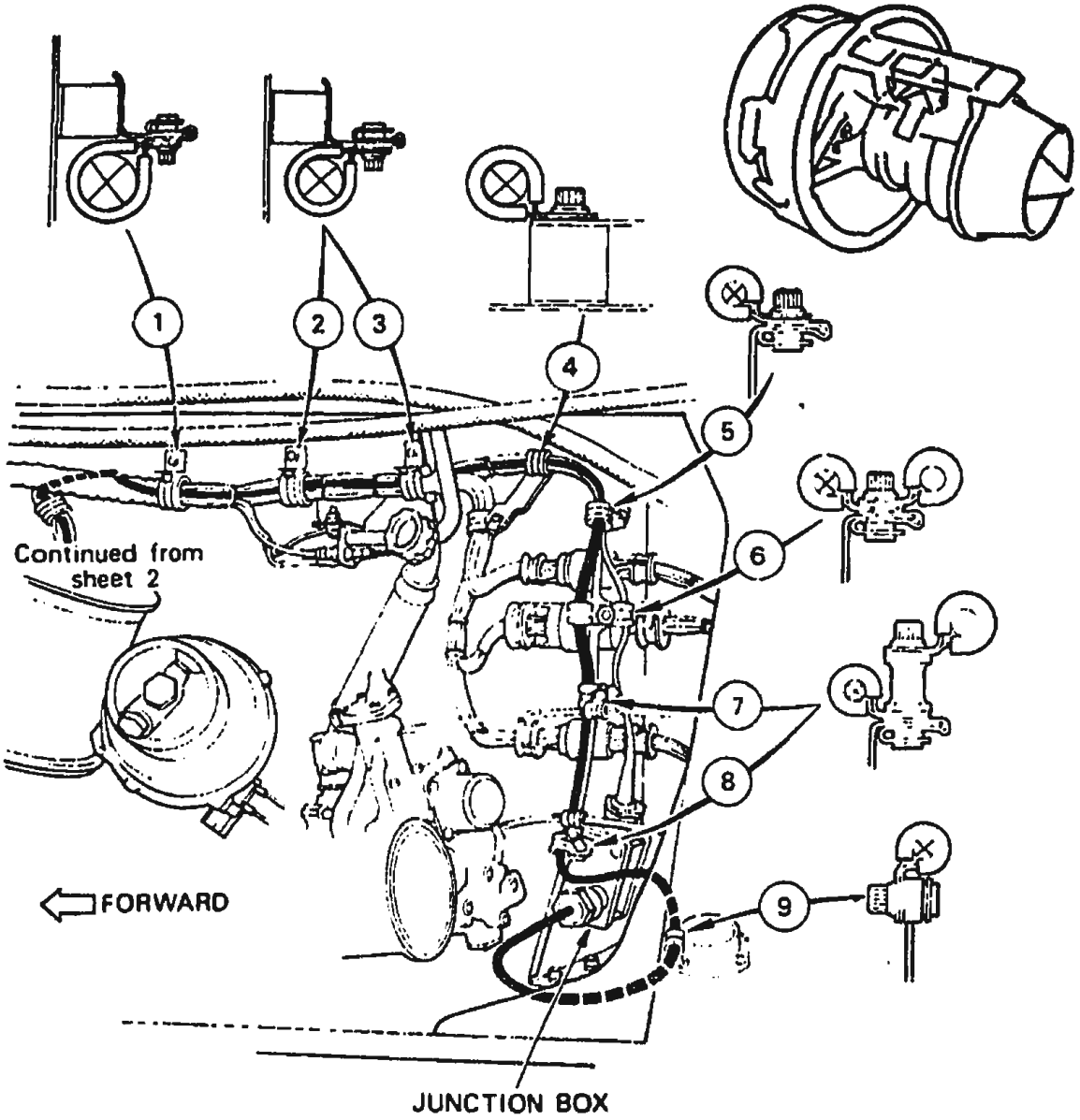
IP Compressor Case Transducer Lead Securing Clips
Figure 404 (Sheet 4)



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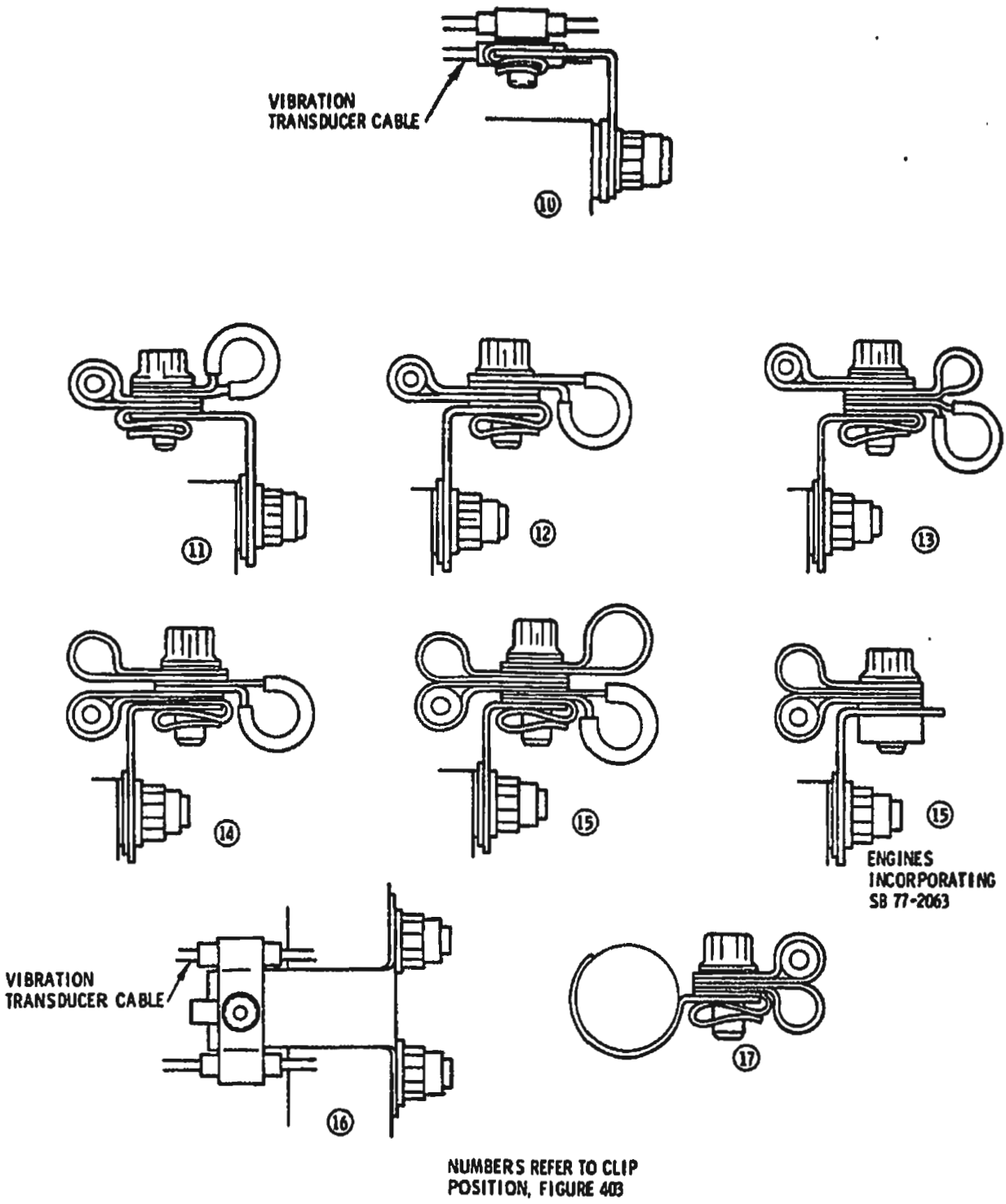
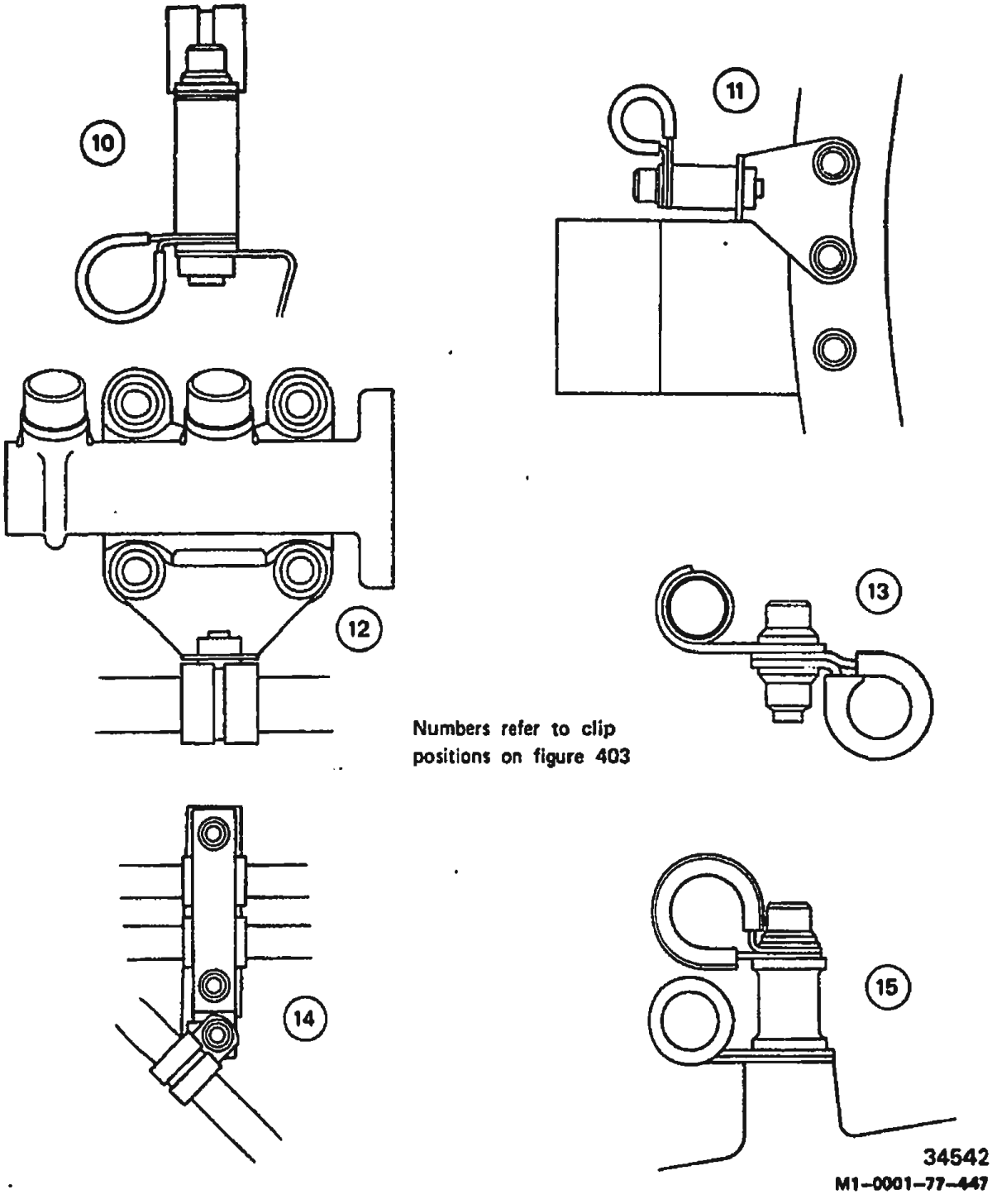
IP Compressor Case Transducer Lead Securing Clips
Figure 404 (Sheet 5)



IP Compressor Case Transducer Lead Assembly
Securing Clip Details
Figure 405

R EFFECTIVITY: WITHOUT RR SB72-3310 AND
R RR SB77-4644
001B



IP Compressor Case Transducer Lead Assembly
Securing Clip Details
Figure 405

R EFFECTIVITY: WITH RR SB72-3310, WITHOUT
R RR SB77-4644
001B

CAUTION: ENSURE A NEW NICKEL WASHER IS IN POSITION AT SHOULDER OF LEAD ASSEMBLY (3).

ENSURE THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(a) On engines with RR SB77-5388, slide back connecting nut (2), install a new nickel washer on lead assembly (3) then fully insert lead assembly into transducer electrical receptacle.

NOTE: Ensure positive location of key.

CAUTION: DO NOT TURN CLAMP NUT.

(b) On engines without RR SB77-5388, screw connecting nut (2) onto transducer and torque to 60 lb in. (6.78 Nm).

(b) On engines with RR SB77-5388, screw connecting nut (2) onto transducer and torque to 60 lb in. (6.78 Nm). Utilizing locking tab, lock-wire connecting nut.

CAUTION: DO NOT LOOSEN CONNECTING NUT (2) TO ALIGN RECESSES.

DO NOT EXCEED 100 LB IN. (11.31 Nm) TORQUE ON CONNECTING NUT.

(c) On engines without RR SB77-5388, install locking clip (1). If necessary tighten connecting nut (2) slightly to align recesses in connecting nut and clamp nut with lugs on locking clip.

(c) On engines with RR SB77-3168, lock-wire locking clip (1).

(4) On engines with RR SB77-4416 or RR SB71-5325, connect transducer lead assembly as follows (Ref. Fig. 401):

CAUTION: ENSURE ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(a) On engines without RR SB77-5388, slide back connecting nut (6) and fully insert

lead assembly (7) into transducer electrical receptacle.

NOTE: Ensure positive location key.

CAUTION: ENSURE A NEW NICKEL WASHER IS IN POSITION AT SHOULDER OF LEAD ASSEMBLY (7).

ENSURE THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(a) On engines with RR SB77-5388, slide back connecting nut (6), install a new nickel washer on lead assembly (7) then fully insert lead assembly into transducer electrical receptacle.

NOTE: Ensure positive location of key.

(b) On engines without RR SB77-5322, screw connecting nut (6) onto transducer, torque to 60 lb in. (6.78 Nm) and lock-wire.

(b) On engines with RR SB77-5322,

(i) Apply a thin film of grease to transducer connector threads. Screw connecting nut (6) onto transducer and torque 60 to 100 lb in. (6.78 to 11.31 Nm). Wipe off excess grease.

(ii) Using a single length of lock-wire, lock-wire units together in the following sequence:

Locking tab, to connector nut (6).

Connector nut (6), to connector body and lead assembly (7).

(iii) Using a separate length of lock-wire, lock-wire connector body to lead assembly (7).

(5) Install transducer lead assembly as follows (Ref. Fig. 403):

(a) On engines without RR SB72-3198, pass lead assembly through opening in interservices fairing floor, cover (9) and seal housing (8) then temporarily secure.

(a) On engines with RR SB72-3198, pass lead assembly through opening in interservices fairing floor.

(b) Position and secure clips (10) through (15).

CR CR CR CR CAUTION: ENSURE CORRECT ROUTING OF LEAD ASSEMBLY THROUGH INSERT HALVES [REF. 4.G.(5)(c)], OTHERWISE CABLE WILL CHAFE ON EDGE OF SEAL HOUSING OR COVER.

(c) On engines without RR SB72-3198, position insert halves (7) in seal housing (8). Install cover (9) and seal housing (8) on interservices fairing floor with nuts and bolts (6).

CR CR CR CR CAUTION: ENSURE CORRECT ROUTING OF LEAD ASSEMBLY THROUGH INSERT HALVES [REF. 4.G.(5)(c)], OTHERWISE CABLE WILL CHAFE ON EDGE OF SEAL HOUSING OR COVER.

(c) On engines with RR SB72-3198, install two piece cover (9), insert halves (7) and two piece seal housing (8) on interservices fairing floor with securing bolts (6).

(d) Form excess lead assembly into a coil and secure in interservices fairing.

(e) Insert harness leads through junction box connector. Install harness leads on junction box terminal posts with nuts (4).

(f) Screw connector (5) onto junction box connector and secure.

(g) Position seal in junction box recess and install packing piece (3) (legs first) into junction box. Install cover (2) and secure with nuts (1).

NOTE: Replace seal if cracked or frayed.

(h) Using lacing tape, tie lead assembly to loom as described in Figure 408. Using silicon varnish, cement lacing tape knots.

CR CAUTION: PRIOR TO INSTALLING ACCESS PANELS, ASSURE THAT

CR THRUST REVERSER FLEXIBLE DRIVE SUPPORT (78-31-08
CR FIG. 401 (SHEET 2) ITEM 3) IS PROPERLY SECURED.
CR DAMAGE TO LEAD ASSEMBLY MAY OCCUR IF FLEXIBLE
CR DRIVE IS NOT RESTRAINED AND IS ALLOWED TO WHIP
CR DURING REVERSER OPERATION.

(6) Install access panels removed in Step 4G(4) (Ref. 72-03-00).

(7) Remove working platform from cold stream duct.

(8) Unlock and reactivate thrust reverser and associated systems (Ref. 78-30-00).

(9) Remove tags and close circuit breakers opened in Step 4G(2).

H. On Engines With RR SB72-3310 and RR SB77-4644, Installation of IP Compressor Case Transducer Lead Assembly.

(1) Ensure that thrust reverser is locked and systems are deactivated and tagged as described in Step 4G(2).

(2) Position working platform in cold stream duct.

(3) Install transducer lead assembly as follows:

(a) On engines without RR SB72-3198, pass lead assembly through opening in interservices floor cover (9), seal housing (8) and temporarily secure (Ref. Fig. 403).

(a) On engines with RR SB72-3198, pass lead assembly through opening in interservices fairing floor (Ref. Fig. 403).

(b) Position new lead assembly under clips (1) through (4) and (8) through (12) on loom then secure clips. Position and secure clips (5) through (7) [Ref. 404 (Sheet 2)].

(c) Position new lead assembly under clips (12) through (19) on loom then secure clips. Position and secure clips (20) and (21) [Ref. Fig. 404 (Sheet 3)].

(d) On engines with RR SB77-4644 and RR SB77-5506 proceed as follows:

(i) Position new lead assembly under clips (1) through (4) and (8) through (11) on loom and

secure clips. Install and secure clips (5) through (7) [Ref. Fig. 404 (Sheet 4)].

(ii) Position new lead assembly under clips (1) through (3) on loom and secure clips. Install and secure clip (9) [Ref. Fig. 404 (Sheet 5)].

(e) On engines without RR SB72-3198, position insert halves (7) in seal housing (8). Install cover (9) and seal housing (8) on interservices fairing floor with nuts and bolts (6) (Ref. Fig. 403).

NOTE: Ensure correct routing of lead assembly through insert halves [Ref. 4G(5)(c)].

(e) On engines with RR SB72-3198, install two piece cover (9), insert halves (7) and two piece seal housing (8) on interservices fairing floor with securing bolts (6) (Ref. Fig. 403).

NOTE: Ensure correct routing of lead assembly through insert halves [Ref. 4G(5)(c)].

(f) Insert harness leads through junction box connector. Install harness leads on junction box terminal posts with nuts (4) (Ref. Fig. 403).

(g) Screw connector (5) onto junction box connector and secure (Ref. Fig. 403).

(h) Position seal in junction box recess and install packing piece (3) (leis first) into junction box. Install cover (2) and secure with nuts (1).

NOTE: Replace seal if cracked or frayed.

(i) On engine with RR SB77-4644 and RR SB77-5506 connect lead assembly as follows (Ref. Fig. 401):

CAUTION: ENSURE A NEW NICKEL WASHER (2) IS IN POSITION AT SHOULDER OF LEAD ASSEMBLY (6).

ENSURE ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(i) Slide back connector nut (1), install new nickel washer (2) on lead assembly (6).

(ii) Fully insert lead assembly into transducer electrical receptacle.

NOTE: Ensure positive location of key.

(iii) Screw connecting nut (1) onto transducer and torque to 60 lb-in. (6.78Nm). Lock-wire connecting nut and locking tab.

(4) On engines without RR SB77-4416, connect transducer lead assembly as follows (Ref. Fig. 401):

CAUTION: ENSURE A NEW SEAL RING IS IN POSITION AT SHOULDER OF LEAD ASSEMBLY (3).

ENSURE THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(a) On engines without RR SB77-5388, slide back connecting nut (2), install new seal ring on lead assembly (3) then fully insert lead assembly into transducer electrical receptacle (Ref. 70-02-01).

NOTE: Ensure positive location of key.

CAUTION: ENSURE A NEW NICKEL WASHER IS IN POSITION AT SHOULDER OF LEAD ASSEMBLY (3).

ENSURE THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(a) On engines with RR SB77-5388, slide back connecting nut (2), install a new nickel washer on lead assembly (3) then fully insert lead assembly into transducer electrical receptacle.

NOTE: Ensure positive location of key.

CAUTION: DO NOT TURN CLAMP NUT.

(b) On engines without RR SB77-5388, screw connecting nut (2) onto transducer and torque to 60 lb in. (6.78 Nm).

(b) On engines with RR SB77-5388, screw connecting nut (2) onto transducer and

torque to 60 lb in. (6.78 Nm). Utilizing locking tab, lock-wire connecting nut.

CAUTION: DO NOT LOOSEN CONNECTING NUT (2) TO ALIGN RECESSES.

DO NOT EXCEED 100 LB IN. (11.31 Nm) TORQUE ON CONNECTING NUT.

(c) On engines without RR SB77-5388, install locking clip (1). If necessary tighten connecting nut (2) slightly to align recesses in connecting nut and clamp nut with lugs on locking clip.

(c) On engines with RR SB77-3168, lock-wire locking clip (1).

(4) On engines with RR SB77-4416 and RR SB7-5325, connect transducer lead assembly as follows (Ref. Fig. 401):

CAUTION: ENSURE ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(a) On engines without RR SB77-5388, slide back connecting nut (6) and fully insert lead assembly (7) into transducer electrical receptacle.

NOTE: Ensure positive location key.

CAUTION: ENSURE A NEW NICKEL WASHER IS IN POSITION AT SHOULDER OF LEAD ASSEMBLY (7).

ENSURE THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(a) On engines with RR SB77-5388, slide back connecting nut (6), install a new nickel washer on lead assembly (7) then fully insert lead assembly into transducer electrical receptacle.

NOTE: Ensure positive location of key.

(b) On engines without RR SB77-5322, screw connecting nut (6) onto transducer. Torque to 60 lb in. (6.78 Nm) and lock-wire connecting nut.

(b) On engines with RR SB77-5322

(i) Apply a thin film of grease to transducer connector threads. Screw connecting nut (6) onto transducer and torque 60 to 100 lb in. (6.78 to 11.31 Nm). Wipe off excess grease.

(ii) Using a single length of lock-wire, lock-wire units together in the following sequence:

Locking tab to connector unit (6).

Connector nut (6), to connector body and lead assembly (7).

(iii) Using a separate length of lock-wire, lock-wire connector body to lead assembly (7).

(5) Using lacing tape, tie lead assembly to loom. Using silicon varnish, cement lacing tape knots (Ref. Fig. 408).

CR CAUTION: PRIOR TO INSTALLING ACCESS PANELS, ASSURE THAT
CR THRUST REVERSER FLEXIBLE DRIVE SUPPORT (78-31-08
CR FIG. 401 (SHEET 2) ITEM 3) IS PROPERLY SECURED.
CR DAMAGE TO LEAD ASSEMBLY MAY OCCUR IF FLEXIBLE
CR DRIVE IS NOT RESTRAINED AND IS ALLOWED TO WHIP
CR DURING REVERSER OPERATION.

(6) Install access panels removed in Step 4G(4) (Ref. 72-03-00).

(7) Remove working platform from cold stream duct.

(8) Unlock and reactivate thrust reverser and associated systems (Ref. 78-30-00).

(9) Remove tags and close circuit breakers opened in Step 4G(2).

I. On Engines Without RR SB72-3732 and RR SB77-4644, Removal of IP Turbine Case Transducer Lead Assembly.

NOTE: Due to the difficulty experienced in removing and installing the transducer lead assembly on installed engines, an alternative procedure can be used (Ref. Step 4K). The alternate procedure ties a new lead assembly to the existing one which has been cut back.

(1) Deactivate and tag thrust reverser and associated systems and install thrust reverser locks (Ref. 78-30-00).

(2) On Pilots overhead circuit breaker panel CB1, zone 210, open and tag applicable circuit breaker ENGINE START CONT (E13, E14 or E15).

On FE/SO aft circuit breaker panel CB3, zone 215, open and tag applicable circuit breakers ENG VIB (R2) and ENG VIB LT (R3).

(3) Position working platform in cold stream duct.

(4) Remove the following access panels:

(a) Engine No. 1 and Engine No. 3.

Turbine Section Lower Fairing 417A or 427A.

Turbine Section RH Fairing 416BR or 426BR.

RH interservices Access Panel 418BR or 428BR.

Pylon Fairing Upper RH Access Panel 418CR or 428CR.

(b) Engine No. 2

Turbine Section Lower Fairing 437A.

Turbine Section RH Fairing 436BR.

RH Interservices Access Panel 438BR.

Pylon Fairing Upper RH Access Panel 438CR.

(5) Remove transducer lead assembly as follows (Ref. Fig. 406):

(a) Remove nuts (1), junction box cover (2) and withdraw packing piece (3).

(b) Remove nuts (4), lift cable assembly leads from terminal posts then disconnect connector (5).

(c) On engines without RR SB77-3254, remove bolts (6).

(c) On engines with RR SB77-3254, remove bolt (6A) and clip (6B) from transducer

lead assembly then remove bolts (6) and bracket (6C).

NOTE: Retain clip (6B) for installation with new lead assembly.

(d) Remove two piece seal housing (7), insert halves (8) and two piece cover (9).

NOTE: Note cable routing through insert halves for subsequent installation.

(e) On engines without RR SB72-3310, remove clips (10) through (13).

NOTE: Retain clips for installation with new lead assembly.

(e) On engines with RR SB72-3310, remove clips (10), (11) and (11a) through (13).

NOTE: Retain clips for installation with new lead assembly.

(f) Uncoil lead assembly in interservices fairing and withdraw through opening in fairing floor.

(g) On engines without RR SB77-4416, remove locking clip (1) (Ref. Fig. 402).

CAUTION: ENSURE ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE DISCONNECTING.

(h) Unscrew connecting nut (2) or (6) and remove lead assembly (3) or (7) from transducer electrical receptacle (Ref. Fig. 402).

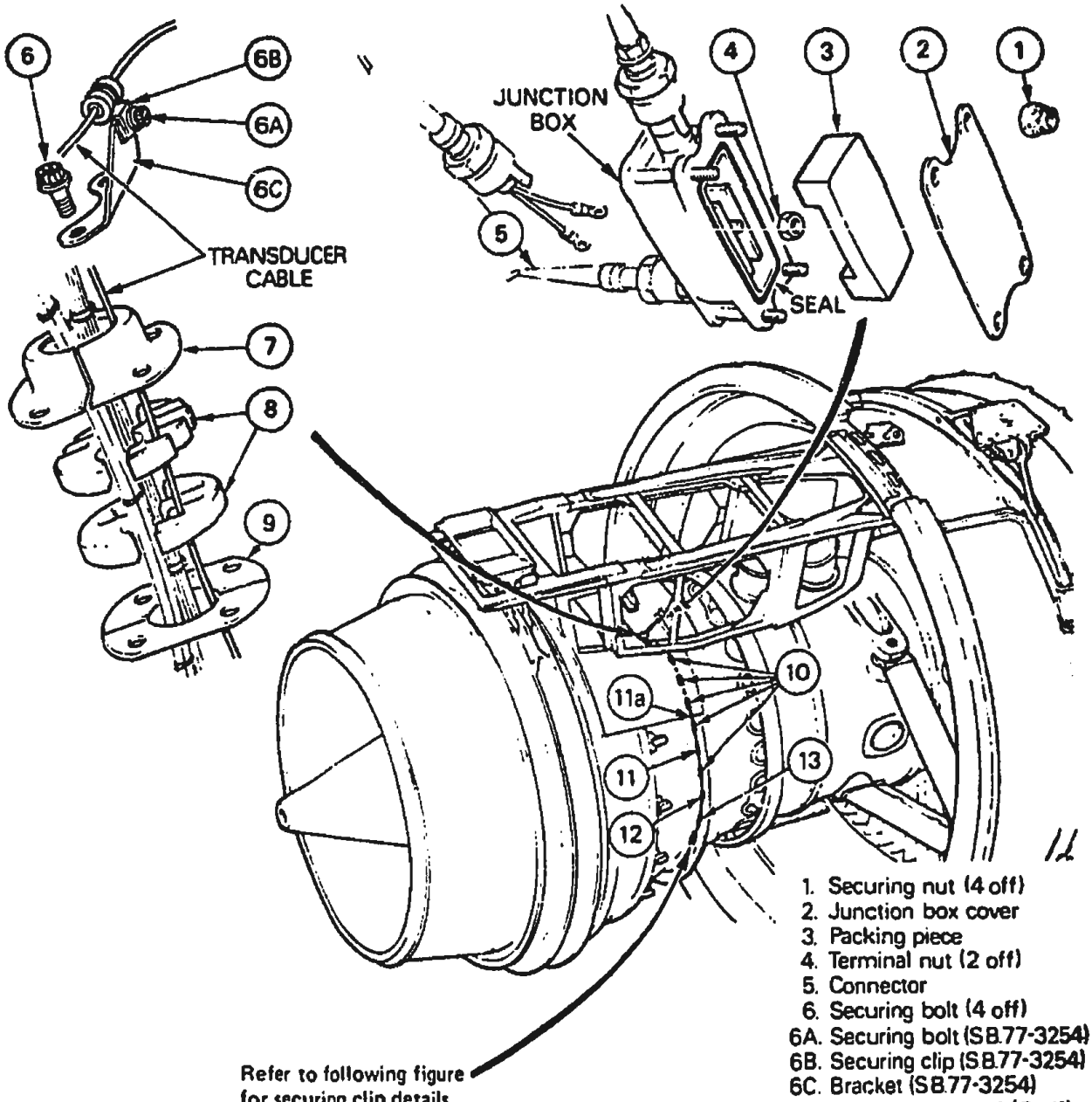
(i) On engines without RR SB77-5388, remove and discard seal ring.

(i) On engines with RR SB77-5388, remove and discard nickel washer.

(j) Remove lead assembly.

J. On Engines Without RR SB72-3732 and RR SB77-4644, Installation of IP Turbine Case Transducer Lead Assembly.

(1) Ensure thrust reverser is locked and systems are deactivated and tagged as described in Step 4I(2).



1. Securing nut (4 off)
2. Junction box cover
3. Packing piece
4. Terminal nut (2 off)
5. Connector
6. Securing bolt (4 off)
6A. Securing bolt (S.B.77-3254)
6B. Securing clip (S.B.77-3254)
6C. Bracket (S.B.77-3254)
7. Seal housing half (2 off)
8. Insert half (4 off)
9. Cover half (2 off)
10.
11.
11a. S.B.72-3310 } Securing clip
12.
13.

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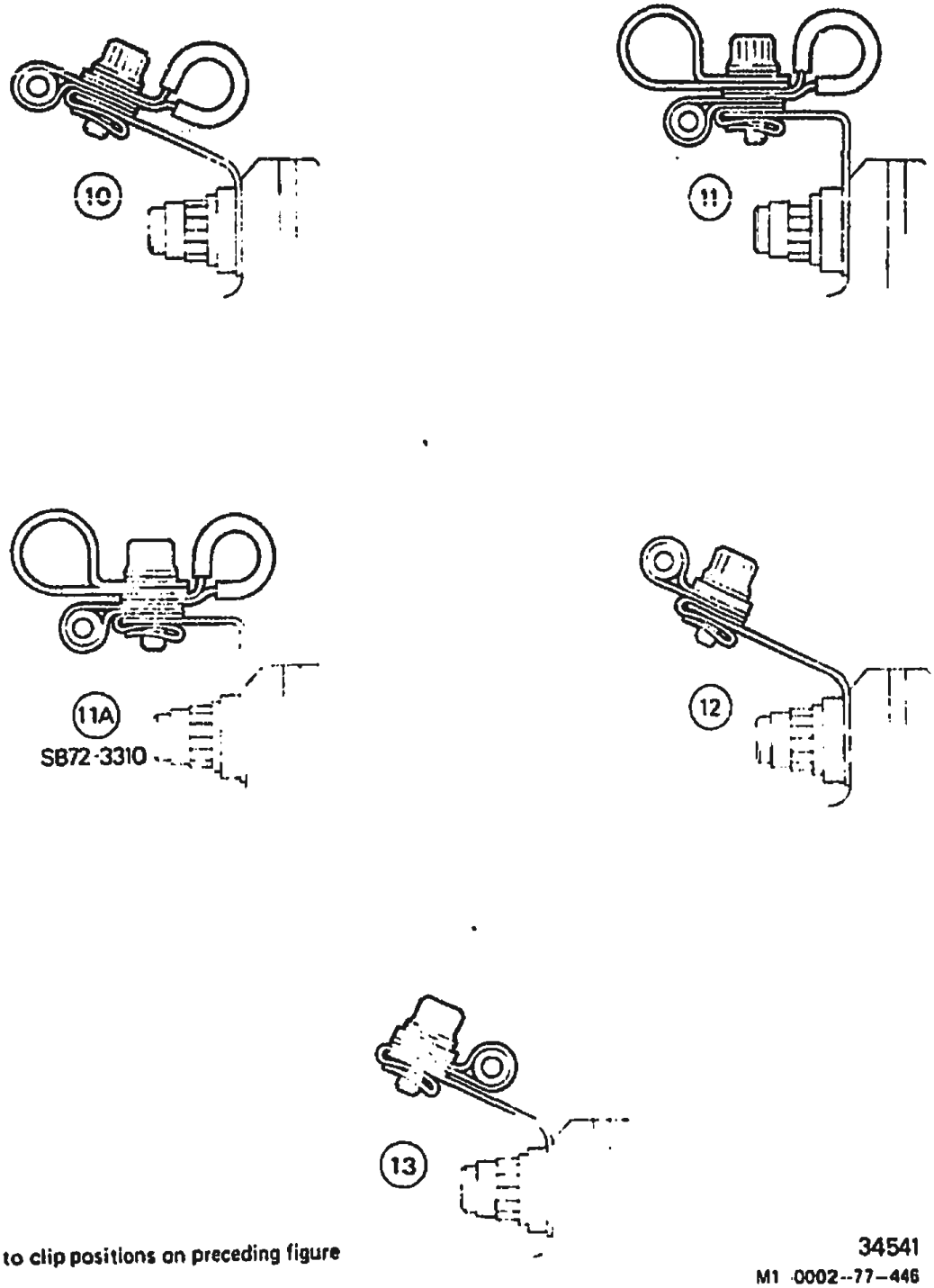
IP Turbine Case Transducer Lead Assembly
Figure 406

R EFFECTIVITY: WITHOUT RR SB72-3732 AND
R RR SB77-4644
001B



Numbers refer to clip positions on preceding figure

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IP Turbine Case Transducer Lead Assembly
Securing Clip Details
Figure 407

R EFFECTIVITY: WITHOUT RR SB72-3732 AND
R RR SB77-4644
001B

(2) Position working platform in cold stream duct.

(3) On engines without RR SB72-3310, position clips (10) through (13) on new lead assembly (Ref. Fig. 406).

(3) On engines with RR SB72-3310, position clips (10), (11) and (11a) through (13) on new lead assembly (Ref. Fig. 406).

(4) Pass lead assembly through opening in interservices fairing floor and temporarily secure.

(5) On engines without RR SB77-4416, connect transducer lead assembly as follows (Ref. Fig. 402):

CAUTION: ENSURE A NEW SEAL RING IS IN POSITION AT SHOULDER OF LEAD ASSEMBLY (3).

ENSURE THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(a) On engines without RR SB77-5388, slide back connecting nut (2), install new seal ring in lead assembly (3) then fully insert lead assembly into transducer electrical receptacle (Ref. 70-02-01).

NOTE: Ensure positive location of key.

CAUTION: ENSURE A NEW NICKEL WASHER IS IN POSITION AT SHOULDER OF LEAD ASSEMBLY (3).

ENSURE THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(a) On engines with RR SB77-5388, slide back connecting nut (2), install a new nickel washer on lead assembly (3) then fully insert lead assembly into transducer electrical receptacle.

NOTE: Ensure positive location of key.

CAUTION: DO NOT TURN CLAMP NUT.

(b) On engines without RR SB77-5388, screw connecting nut (2) onto transducer then torque to 60 lb in. (6.78 Nm).

(b) On engines with RR SB77-5388, screw connecting nut (2) onto transducer and torque to 60 lb in. (6.78 Nm). Utilizing locking tab, lock-wire connecting nut.

CAUTION: DO NOT LOOSEN CONNECTING NUT (2) TO ALIGN RECESSES.

DO NOT EXCEED 100 LB IN. (11.31 Nm) TORQUE ON CONNECTING NUT.

(c) On engines without RR SB77-5388, install locking clip (1). If necessary tighten connecting nut (2) slightly to align recesses in connecting nut and clamp nut with lugs on locking clip.

(c) On engines with RR SB77-3168, lock-wire locking clip (1).

(5) On engines with RR SB77-4416 or RR SB71-5325, connect transducer lead assembly as follows (Ref. Fig. 402).

CAUTION: ENSURE ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(a) On engines without RR SB77-5388, slide back connecting nut (6) and fully insert lead assembly (7) into transducer electrical receptacle.

NOTE: Ensure positive location key.

CAUTION: ENSURE A NEW NICKEL WASHER IS IN POSITION AT SHOULDER OF LEAD ASSEMBLY (7).

ENSURE THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(a) On engines with RR SB77-5388, slide back connecting nut (6), install a new nickel washer on lead assembly (7) then fully insert lead assembly into transducer electrical receptacle.

NOTE: Ensure positive location of key.

(b) On engines with RR SB77-5388, without RR SB77-5322,

screw connecting nut (6) onto transducer then torque to 60 lb in. (6.78 Nm). Utilizing locking tab, lock-wire connecting nut.

(b) On engines with RR SB77-5322

(i) Apply a thin film of grease to transducer connector threads, screw connecting nut (6) onto transducer and torque 60 to 100 lb in. (6.78 to 11.31 Nm). Wipe off excess grease.

(ii) Using a single length of lock-wire, lock-wire units together in the following sequence:

Locking tab to connector nut (6).

Connector nut (6), to connector body and lead assembly (7).

(iii) Using a separate length of lock-wire, lock-wire connector body to lead assembly (7).

(6) Install transducer lead assembly as follows (Ref. Fig. 406):

(a) On engines without RR SB72-3310, position and secure clips (10) through (13).

(a) On engines with RR SB72-3310, position and secure clips (10), (11) and (11a) through (13).

CR CAUTION: ENSURE CORRECT ROUTING OF LEAD ASSEMBLY
CR THROUGH INSERT HALVES [REF. 4.I.(5)(d)],
CR OTHERWISE CABLE WILL CHAFE ON EDGE OF SEAL
CR HOUSING OR COVER.

(b) On engines without RR SB77-3254, install insert halves (8) in seal housing halves (7). Install cover halves (9) and seal housing halves (7) on interservices fairing floor with bolts (6).

CR CAUTION: ENSURE CORRECT ROUTING OF LEAD ASSEMBLY
CR THROUGH INSERT HALVES [REF. 4.I.(5)(d)],
CR OTHERWISE CABLE WILL CHAFE ON EDGE OF SEAL
CR HOUSING OR COVER.

(b) On engines with RR SB77-3254, install insert halves (8) in seal housing halves (7). Install cover halves (9), seal housing

halves (7) and bracket (6C) on interservices fairing floor with bolts (6). Position clip (6B) on lead assembly and secure to bracket (6C) with bolt (6A).

(c) Form excess lead assembly into a coil and secure in interservices fairing.

(d) Insert harness leads through junction box connector. Install harness leads on junction box terminal posts with nuts (4).

(e) Screw connector (5) onto junction box connector and secure.

(f) Position seal in junction box recess and install packing piece (3) (legs first) into junction box. Install cover (2) with nuts (1).

NOTE: Replace seal if cracked or frayed.

CR CAUTION: PRIOR TO INSTALLING ACCESS PANELS, ASSURE THAT
CR THRUST REVERSER FLEXIBLE DRIVE SUPPORT (78-31-08
CR FIG. 401 (SHEET 2) ITEM 3) IS PROPERLY SECURED.
CR DAMAGE TO LEAD ASSEMBLY MAY OCCUR IF FLEXIBLE
CR DRIVE IS NOT RESTRAINED AND IS ALLOWED TO WHIP
CR DURING REVERSER OPERATION.

(7) Install access panels removed in Step 4I(4), (Ref. 72-03-00).

(8) Remove working platform from cold stream duct.

(9) Unlock and reactivate thrust reverser and associated systems (Ref. 78-30-00).

(10) Remove tags and close circuit breakers opened in Step 4I(2).

K. IP Turbine Case Transducer Lead Assembly - Temporary Replacement Procedure.

NOTE: The following lead assembly replacement procedure is a temporary measure, and is only applicable to engines without RR SB77-3732, RR SB77-4644 or RR SB77-5387.

It is recommended that the unserviceable lead assembly is removed and discarded and that the new lead assembly is installed at the operators earliest opportunity (Ref. 4J).

(1) Deactivate and tag thrust reverser and associated systems, and install thrust reverser locks (Ref. 78-30-00).

(2) On Pilots overhead circuit breaker panel, CB1, zone 210, open and tag applicable circuit breaker ENGINE START CONT (E13, E14 or E15).

On FE/SO aft circuit breaker panel CB3, zone 215, open and tag applicable circuit breakers ENG VIB (R2), and ENG VIB LT (R3).

(3) Position working platform in cold stream duct.

(4) Remove the following access panels (Ref. 72-03-00).

(a) Engine No. 1 and No. 3:

Turbine Section Lower Fairing 417A or 427A

Turbine Section RH Fairing 416BR or 426BR

RH Interservices Access Panel 418BR or 426BR

Pylon Fairing Upper RH Access Panel 418CR or 418CR.

(b) Engine No. 2:

Turbine Section Lower Fairing 437A

Turbine Section RH Fairing 436BR

RH Interservices Access Panel 438BR

Pylon Fairing Upper RH Access Panel 438CR.

(5) Remove Compresscr Lead Assembly as follows (Ref. Fig. 406):

(a) Remove nuts (1), junction box cover (2) and withdraw packing piece (3).

(b) Remove nuts (4), lift cable assembly leads from terminal posts then disconnect connector (5).

(c) On engines without RR SB77-3254, remove bolts (6).

(c) On engines with RR SB77-3254, remove bolt (6A) and clip (6B) from transducer lead assembly, then remove bolts (6) and bracket

(6C). Retain clip (6B) for installation with new lead assembly.

(d) Remove seal housing halves (7), insert halves (8) and cover halves (9).

NOTE: Note cable routing through insert halves for subsequent installation.

(e) Cut off cable end to prevent reuse.

(f) On engines without RR SB77-4416, remove clip (1) (Ref. Fig. 402).

CAUTION: ENSURE ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE DISCONNECTING.

(g) Unscrew connecting nut (2) or (6) and remove cable assembly (3) or (7) from transducer electrical receptacle.

(h) On engines without RR SB77-5388, remove and discard seal ring.

(h) On engines with RR SB77-5388, remove and discard nickel washer.

(i) Cut off cable end to prevent reuse.

(j) Position replacement lead assembly against existing lead assembly, pass end through opening in interservices fairing floor and temporarily secure.

(6) On engines without RR SB77-4416, connect transducer replacement lead assembly as follows (Ref. Fig. 402):

CAUTION: ENSURE A NEW SEAL RING IS IN POSITION AT SHOULDER OF LEAD ASSEMBLY (3).

ENSURE THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(a) On engines without RR SB77-5388, slide back connecting nut (2), install new seal ring on lead assembly (3) then fully insert lead assembly into transducer electrical receptacle (Ref. 70-02-01).

NOTE: Ensure positive location of key.

CAUTION: ENSURE A NEW NICKEL WASHER IS IN POSITION AT SHOULDER OF LEAD ASSEMBLY (3).

ENSURE THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(a) On engines with RR SB77-5388, slide back connecting nut (2), install a new nickel washer on lead assembly (3) then fully insert lead assembly into transducer electrical receptacle.

NOTE: Ensure positive location of key.

CAUTION: DO NOT TURN CLAMP NUT.

(b) On engines without RR SB77-5388, screw connecting nut (2) onto transducer then torque to 60 lb in. (6.78 Nm).

(b) On engines with RR SB77-5388, screw connecting nut (2) onto transducer and torque to 60 lb in. (6.78 Nm). Utilizing locking tab, lock-wire connecting nut.

CAUTION: DO NOT LOOSEN CONNECTING NUT (2) TO ALIGN RECESSES.

DO NOT EXCEED 100 LB IN. (11.31 Nm) TORQUE ON CONNECTING NUT.

(c) On engines without RR SB77-5388, install locking clip (1). If necessary tighten connecting nut (2) slightly to align recesses in connecting nut and clamp nut with lugs on locking clip.

(c) On engines with RR SB77-3168, lock-wire locking clip (1).

(6) On engines with RR SB77-4416 or RR SB71-5325, connect transducer replacement lead assembly as follows (Ref. Fig. 402):

CAUTION: ENSURE ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(a) On engines without RR SB77-5388, slide back connecting nut (6) and fully insert lead assembly (7) into transducer electrical receptacle.

NOTE: Ensure positive location key.

CAUTION: ENSURE A NEW NICKEL WASHER IS IN POSITION AT SHOULDER OF LEAD ASSEMBLY (7).

ENSURE THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(a) On engines with RR SB77-5388, slide back connecting nut (6), install a new nickel washer on lead assembly (7) then fully insert lead assembly into transducer electrical receptacle.

NOTE: Ensure positive location of key.

(b) On engines with RR SB77-5388, without RR SB77-5322, screw connecting nut (6) onto transducer. Torque to 60 lb in. (6.78 Nm) and utilizing locking tab lock-wire.

(b) On engines with RR SB77-5322

(i) Apply a thin film of grease to transducer connector threads. Screw connecting nut (6) onto transducer and torque 60 to 100 lb in. (6.78 to 11.31 Nm). Wipe off excess grease.

(ii) Using a single length of lock-wire, lock-wire units together in the following sequence:

Locking tab, to connector nut (6).

Connector nut (6), to connector body and lead assembly (7).

(iii) Using a separate length of lock-wire, lock-wire connector body to lead assembly (7).

(7) Install transducer replacement lead assembly as follows:

(a) Using lacing tape and working from transducer towards junction box, tie replacement lead assembly to existing lead assembly (Ref. Fig.

407). Using silicon varnish, cement lacing tape knots.

NOTE: Adhesive tape can be used as an alternative to lacing tape.

CR CR CR CR CAUTION: ENSURE CORRECT ROUTING OF LEAD ASSEMBLY THROUGH INSERT HALVES [REF. 4.K.(5)(d)], OTHERWISE CABLE WILL CHAFE ON EDGE OF SEAL HOUSING OR COVER.

(b) On engines without RR SB77-3254, install insert halves (8) in seal housing (7). Install cover halves (9) and seal housing halves (7) on interservices fairing floor with bolts (6) (Ref. Fig. 406).

CR CR CR CR CAUTION: ENSURE CORRECT ROUTING OF LEAD ASSEMBLY THROUGH INSERT HALVES [REF. 4.K.(5)(d)], OTHERWISE CABLE WILL CHAFE ON EDGE OF SEAL HOUSING OR COVER.

(b) On engines with RR SB77-3254, install insert halves (8) in seal housing halves (7). Position cover halves (9), seal housing halves (7) and bracket (6C) on interservices fairing floor then fit and secure bolts (6) (Ref. Fig. 406).

Position clip (6B) on replacement lead assembly then secure to bracket (6C) with bolt (6A).

(c) Form excess cable into a coil and secure in interservices fairing (Ref. Fig. 406).

(d) Insert harness leads through junction box connector. Install harness leads on junction box terminal posts with nuts (4) (Ref. Fig. 406).

(e) Screw connector (5) onto junction box connector and secure.

(f) Position seal in junction box recess and install packirg piece (3) (legs first) into junction box. Install cover (2) with nuts (1) (Ref. Fig. 406).

NOTE: Replace seal if cracked or frayed.

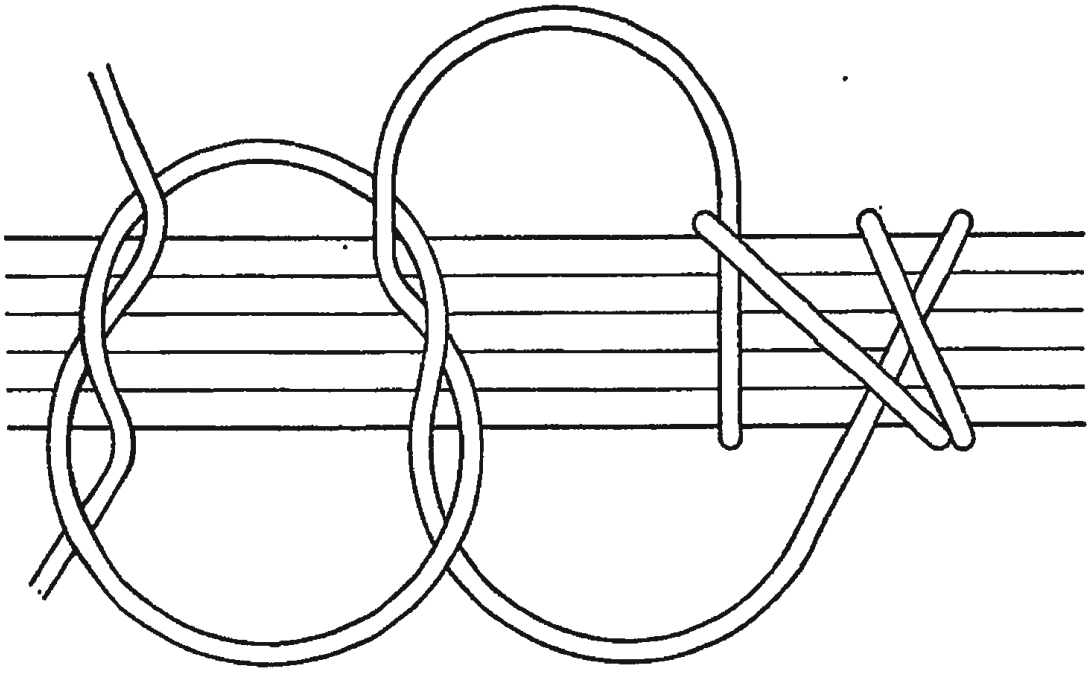
CR CR CR CR CR CR **CAUTION:** PRIOR TO INSTALLING ACCESS PANELS, ASSURE THAT THRUST REVERSER FLEXIBLE DRIVE SUPPORT (78-31-08 FIG. 401 (SHEET 2) ITEM 3) IS PROPERLY SECURED. DAMAGE TO LEAD ASSEMBLY MAY OCCUR IF FLEXIBLE DRIVE IS NOT RESTRAINED AND IS ALLOWED TO WHIP DURING REVERSER OPERATION.

(8) Install access panels removed in Step 4(k)(4).

(9) Remove working platform from cold stream duct.

(10) Unlock and reactivate thrust reverser and associated systems (Ref. 78-30-00).

(11) Remove tags and close circuit breakers opened in Step 4K(2).



PROCEDURE:

1. At intervals not exceeding 3.00 in. (76,2 mm.) throughout the harness, the lacing tape, O-MAT item No. 274, is to be tied as illustrated.
2. The knot must not be tied too tightly so as to result in cutting or penetration of the conductor jacket or insulation of the cable.
3. The finished knots are to be cemented using silicone varnish O-MAT item No. 7/73

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Method Used to Tie Harness Cables Together
Figure 408

L. AVM CONNECTOR REPLACEMENT, (MOUNTING OF CONNECTOR, PART NBR 812-505-000M1-03 (TYPE CG505) ONTO CABLE TYPE MTLN-205-A) TWA STK NBR 61-6724.

(1) REMOVE CORE FARING AS NECESSARY TO GAIN ACCESS TO FAN OR TURBINE AVM PICKUP.

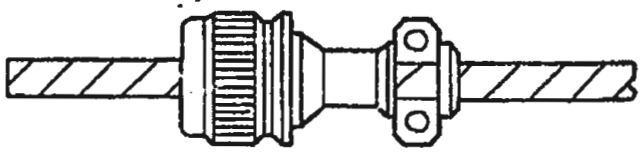
(2) REMOVE CONNECTOR FROM PICKUP.

(a) CHECK CABLE LENGTH TO DETERMINE IF CABLE WILL BE LONG ENOUGH WITH NEW CONNECTOR INSTALLED. (CABLE WILL BE ABOUT 3" SHORTER WITH NEW CONNECTOR).

(b) CUT OLD CONNECTOR OFF CABLE 1/2" FROM CONNECTOR.

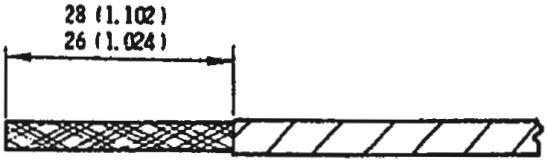
(c) REMOVE SCREWS (30, FIG. 410) AND CABLE CLAMP (20, FIG. 410) FROM REAR CONNECTOR HOUSING.

(d) SLIDE REAR CONNECTOR HOUSING OVER CABLE.

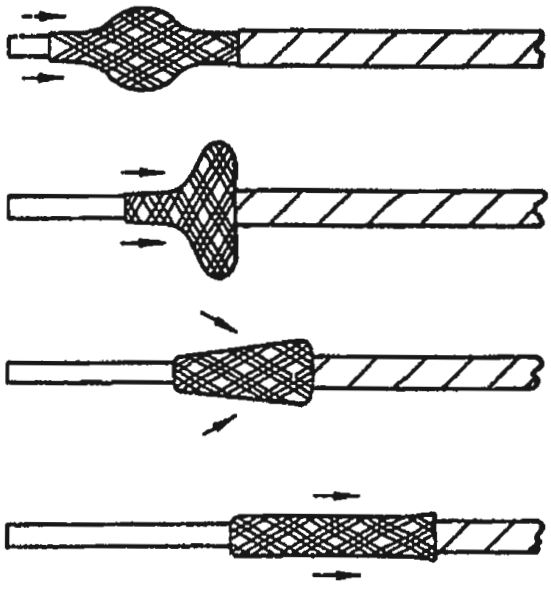


(e) CUT LIGHTLY AROUND THE CIRCUMFERENCE OF THE CABLE OUTER COVER AT A DISTANCE OF 27 (1.063) FROM THE CABLE END. FLEX THE CABLE TO OPEN UP THE CUT AND REMOVE THE 27 (1.063) LENGTH OF OUTER COVER (INCLUDING ORANGE POLYIMIDE) SO THAT THE CABLE SCREEN IS SHOWING.

CAUTION: DO NOT DAMAGE CABLE SCREEN DURING THIS OPERATION.

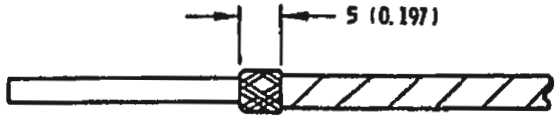


(f) PUSH THE CABLE SCREEN BACK OVER THE PTFE COVER AS SHOWN.

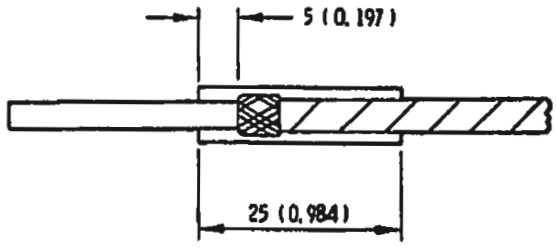


ALL DIMENSIONS ARE IN MILLIMETRES WITH INCH CONVERSIONS IN PARENTHESES.

(g) CUT CABLE SCREEN TO A LENGTH OF 5 (0.197) BY REMOVING REAR PORTION OF FOLDED-BACK SCREEN.



(h) PUSH A PIECE OF SHRINK SLEEVING OVER THE CABLE SCREEN AS SHOWN.



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C
C

Cable Maintenance Procedures
Figure 409 (Sheet 2)

R
R
001B

EFFECTIVITY: ALL

(i) HEAT SHRINK THE SHRINK SLEEVING ONTO THE CABLE USING THE HEAT SOURCE.

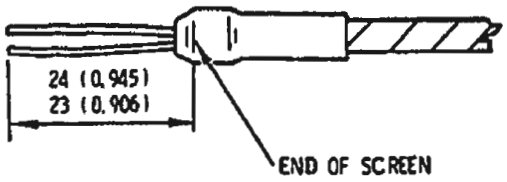
CAUTION: ENSURE CABLE AND SHRINK SLEEVING SHOW NO SIGNS OF HEAT DAMAGE.

(j) REMOVE THE BLACK IMPREGNATED-TAPE AND THE FILLER CHORDS UP TO THE SHRINK SLEEVING.

(k) UNTWIST THE INSULATED CONDUCTORS AND REMOVE THE BLACK IMPREGNATED-LAYER FROM EACH CONDUCTOR.

(l) CLEAN THE REMAINING GRAPHITE DEPOSITS FROM THE INSULATED CONDUCTORS USING SCOTCH BRITE AND INDUSTRIAL ALCOHOL OR A SUITABLE SUBSTITUTE.

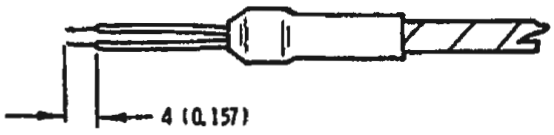
(m) CUT THE INSULATED CONDUCTORS TO A LENGTH OF 23 (0.906) TO 24 (0.945) AS SHOWN (MEASURE FROM END OF SCREEN AS VISIBLE THROUGH SLEEVING.)



(n) REMOVE THE BLUE AND WHITE PTFE INSULATION LAYERS FROM EACH CONDUCTOR AT A DISTANCE OF 4 (0.157) FROM THE END OF THE CABLE.

CAUTION: DO NOT DAMAGE CONDUCTORS DURING STRIPPING PROCEDURES.

NOTE: USE OF HEAT-STRIPPING TOOL FOR THIS OPERATION IS RECOMMENDED BUT IS NOT MANDATORY.



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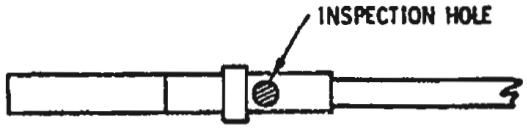
C Cable Maintenance Procedures
C Figure 409 (Sheet 3)

R EFFECTIVITY: ALL
R
001B

(o) PUSH THE COLOUR CODED ENDS OF THE CONTACT PINS ONTO EACH CONDUCTOR.

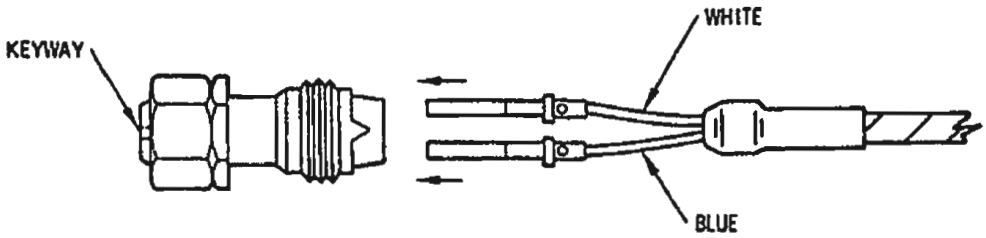
CAUTION: MAKE SURE THAT CONTACT PINS BUTT UP AGAINST PTFE INSULATION AND THAT CENTRAL CONDUCTING CORES ARE VISIBLE THROUGH THE INSPECTION HOLES IN THE CONTACT PINS.



(p) CRIMP CONTACTS USING TOOL AND INSERT POSITIONER.

(q) MOUNT FRONT CONNECTOR-HOUSING OVER PINS AS FOLLOWS.

CAUTION: ENSURE WHITE AND BLUE CONNECTORS ARE ALIGNED WITH FRONT CONNECTOR-HOUSING AS ILLUSTRATED



1) ENGAGE PINS INTO RUBBER BUNG.

2) USE INSERTION (RED) SECTION OF INSERTION/EXTRACTION TOOL.

NOTE: A "CLICK" SHOULD BE HEARD WHEN PINS ENGAGE.

3) CHECK CABLE IS SECURE.

(r) MOVE REAR CONNECTOR-HOUSING OVER THE SHRINK SLEEVING.

(s) ENGAGE NUT OF REAR CONNECTOR HOUSING ONTO THREAD OF FRONT CONNECTOR-HOUSING.

CAUTION: AVOID TWISTING OF CONDUCTORS.

NOTE: DO NOT TIGHTEN NUT AT THIS STAGE.

(t) ALIGN THE CLAMP-BAR SUPPORT ON THE REAR CONNECTOR-HOUSING SO THAT IT IS PARALLEL WITH THE TWO (2) CONTACT SOCKETS ON THE FRONT OF THE CONNECTOR AND ON THE OPPOSITE SIDE TO THE CONNECTOR KEYWAY.

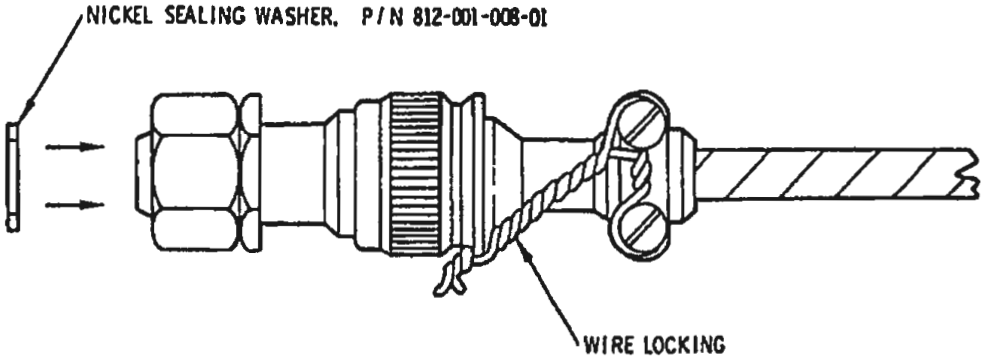
(u) TIGHTEN THE NUT OF THE REAR CONNECTOR-HOUSING ONTO THE FRONT CONNECTOR-HOUSING.

(v) MOUNT THE REAR CABLE CLAMP (20, FIG. 410) ONTO ITS SUPPORT ON THE REAR CONNECTOR-HOUSING (40, FIG. 410)

(w) TIGHTEN THE SCREWS (30, FIG. 410) FIRMLY SO THAT THE CLAMP SEATS SECURELY ONTO ITS SUPPORT.

(x) WIRE-LOCK NUT OF REAR CONNECTOR-HOUSING TO ONE OF THE SCREW HEADS (30, FIG. 410) AND THEN LOCK THE TWO (2) SCREW HEADS TOGETHER AS SHOWN.

(y) ADD NICKEL WASHER (70 FIG. 410)



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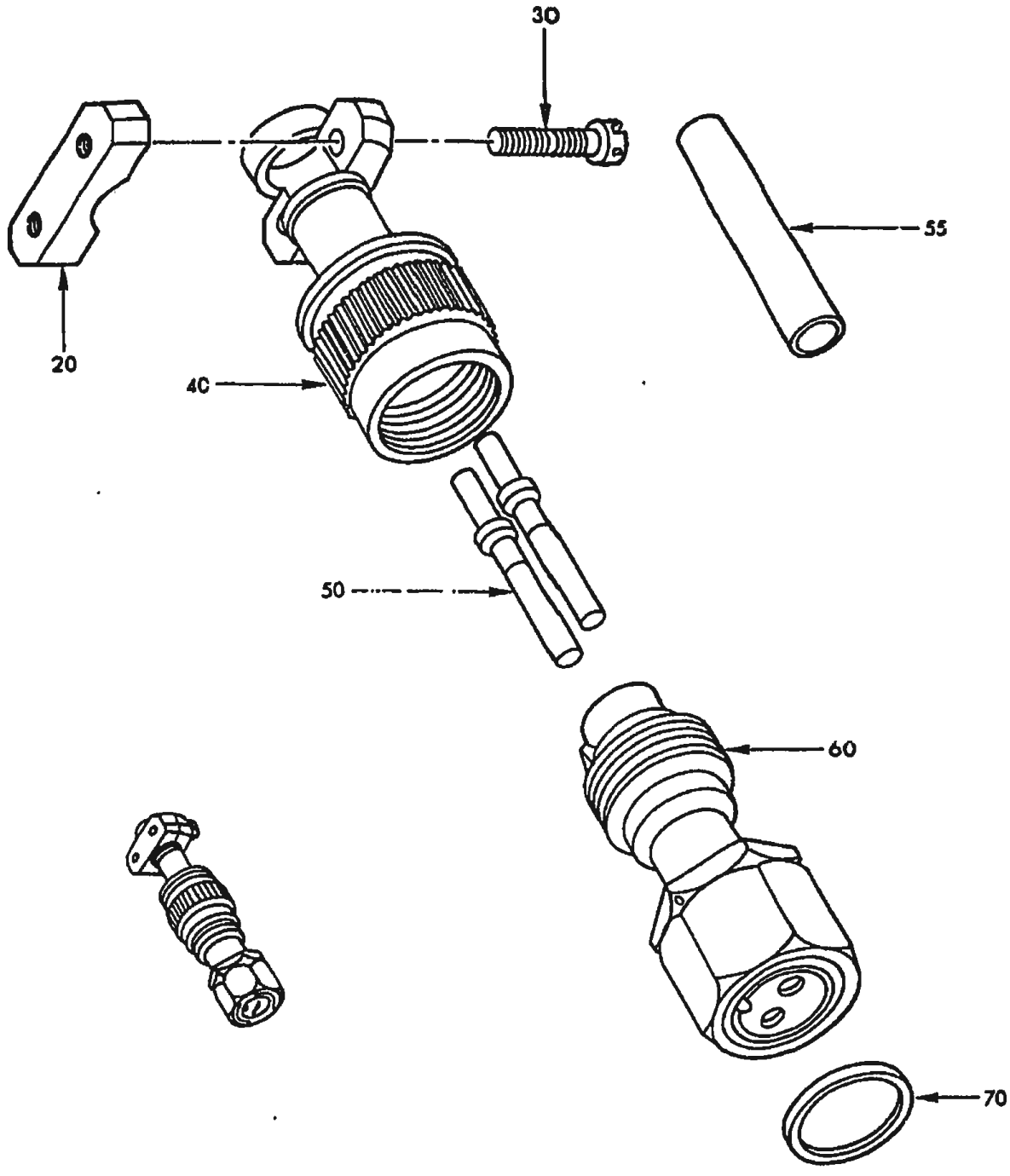

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C C View Of Flexible Cable Connector
Figure 410

R R 001B EFFECTIVITY: ALL

VIBRATION INDICATOR TRANSDUCER - ADJUSTMENT/TEST

1. General

On engines without RR SB72-3310 and RR SB77-4644, one transducer is located on the IP compressor case left-hand side (viewed from the rear) and one on the IP turbine case right-hand side.

R On engines without RR SB72-3310, with RR SB77-4644, the IP turbine case transducer is relocated on the IP compressor case left-hand side below the original IP compressor case transducer.

On engines with RR SB72-3310, without RR SB77-4644, the IP compressor case transducer is relocated on the IP compressor case right-hand side. The other transducer remains in position on the IP turbine case right-hand side.

On engines with RR SB72-3310 and RR SB77-4644, both transducers are relocated adjacent each other on the IP compressor case right-hand side.

2. Equipment and Materials

Working Platform, P/N CP.20309 or XUT.37594 or Spacer, P/N XUT.42526 and Side Piece, P/N XUT.42527

AVO or similar test instrument

Lock-wire, FED Spec QQ-W-390, 0.032-inch diameter; British Spec DTD. 189A 22 SWG; OMat item No. 238; or equivalent

Grease, British Spec DTD. 900/4914 ROCOL GG.17866; OMat item No. 404A.

3. Referenced Procedures:

70-02-01	Identification, Lubrication and Fitting of Rubber Sealing Rings
71-11-00	Cowlings, Engines No. 1 and No. 3 - Servicing
71-12-05	LH and RH Upper Hinged Cowls - Servicing
72-03-00	Gas Generator Fairings - Removal/Installation
78-30-00	Thrust Reverser - Servicing

Service Bulletins referred to:

RR-SB71-5325 - Introduction of LP Compressor (Fancase)/A Frame to Engine Services Loom Assembly Incorporating Vibrometer Connectors

RR SB72-3310 - Compressor Intermediate Case - Introduction of a Steel Fabricated Case

RR SB72-3732 - Light Duty Harness Re-routed through A Frame

RR SB77-3168 - Vibration Transducers and Cables Improved Insulation and Locking Arrangement

RR SB77-4416 - Introduction of Vibration Transducer Improved Connector

RR SB77-4644 - Vibration Indicating System - Repositioned Vibration Transducer

RR SB77-5322 - IP Compressor and IP Turbine Case - Improved Wirelocking of Vibration Transducer Connector

RR SB77-5387 - Introduction of Revised Vibration Monitoring System

RR SB77-5388 - Introduction of Improved Vibrometer Connector Type CG505

R RR SB77-5856 - Engine indicating - Vibration indication system -
R Hexagon headed bolts securing the vibration transmitters
R (transducers) on the airborne vibration monitoring system.

4. On engines without RR SB72-3732 and 77-5387, Adjustment/Test

A. On engines without RR SB72-3310, IP Compressor Case Transducer Lead Assembly Connector Test

NOTE: On engines with RR SB77-4644, the connect/disconnect procedure for both transducer lead assemblies is identical.

WARNING: ENSURE THRUST REVERSER SYSTEM IS LOCKED IN FORWARD THRUST POSITION WHILE WORK IS IN PROGRESS.

(1) Deactivate and tag thrust reverser and associated systems and install thrust reverser locks (Ref. 78-30-00).

(2) On Pilots overhead circuit breaker panel CB1, zone 210, open and tag applicable circuit breaker ENG START CONT (E13, E14 or E15).

On FE/SO aft circuit breaker panel CB3, zone 215, open and tag applicable circuit breakers ENG VIB (R2) and ENG VIB LT (R3).

(3) Position working platform in cold stream duct.

(4) Remove Compressor Section Rear LH Fairing 412FL or 422FL for engines No. 1 or No. 3 or 432FL for engine No. 2 (Ref. 72-03-00).

(5) On engines without RR SB77-4416, remove locking clip (1) (Ref. Fig. 501).

CAUTION: ENSURE ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE DISCONNECTING.

(6) Unscrew connecting nut (2) or (6) and withdraw lead assembly (3) or (7) from transducer electrical receptacle.

(7) On engines without RR SB77-5388, remove and discard seal ring.

(7) On engines with RR SB77-5388, remove and discard nickel washer.

(8) With ohmmeter set to read on the lowest range, connect one terminal to the connector body of transducer lead assembly (3) or (7) [not the connecting nut (2) or (6)] and connect the other terminal to ground.

NOTE: Ensure all connections are good.

(9) Hold connector body firmly; manipulate vibration cable relative to connector body and simultaneously observe ohmmeter reading. If ohmmeter reading fluctuates, the vibration cable is faulty and should be replaced.

(10) Disconnect ohmmeter terminals.

(11) On engines without RR SB77-4416, connect transducer lead assembly as follows:

CAUTION: ENSURE A NEW SEAL RING IS IN POSITION AT SHOULDER OF LEAD ASSEMBLY (3) AND THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(a) On engines without RR SB77-5388, slide back connecting nut (2), install (Ref. 70-20-01) new seal ring on lead assembly (3) then fully insert assembly into transducer electrical receptacle.

NOTE: Ensure positive location of key.

CAUTION: ENSURE A NEW NICKEL WASHER IS IN POSITION AT SHOULDER OF LEAD ASSEMBLY (3) AND THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(a) On engines with RR SB77-5388, slide back connecting nut (2), install a new nickel washer on lead assembly (3) then fully insert lead assembly into transducer electrical receptacle.

NOTE: Ensure positive location of key.

CAUTION: DO NOT TURN CLAMP NUT.

(b) On engines without RR SB77-5388, screw connecting nut (2) onto transducer then torque tighten to 60 lb. in. (6.78 Nm.).

(b) On engines with RR SB77-5388, screw connecting nut (2) onto transducer and torque tighten to 60 lb. in. (6.78 Nm.) then, utilizing locking tab, lock-wire connecting nut.

CAUTION: DO NOT LOOSEN CONNECTING NUT (2) TO ALIGN RECESSES.

DO NOT EXCEED 100 LB. IN. (11.31 Nm.) TORQUE ON CONNECTING NUT.

(c) On engines without RR SB77-5388, install locking clip (1). If necessary, tighten connecting nut (2) slightly to align recesses in connecting and clamp nuts with lugs on locking clip.

(d) On engines with RR SB77-3168, lock-wire locking clip (1).

(11) On engines with RR SB77-4416 or RR SB71-5325, connect transducer lead assembly as follows:

CAUTION: ENSURE THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(a) On engines without RR SB77-5388, slide back connecting nut (6) and fully insert lead assembly (7) into transducer electrical receptacle.

NOTE: Ensure positive location of key.

CAUTION: ENSURE A NEW NICKEL WASHER IS IN POSITION AT SHOULDER OF LEAD ASSEMBLY (7) AND THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(a) On engines with RR SB77-5388, slide back connecting nut (6), install a new nickel washer on lead assembly (7) then fully insert lead assembly (7) then fully insert lead assembly into transducer electrical receptacle.

NOTE: Ensure positive location of key.

(b) On engines without RR SB77-5322, screw connecting nut (6) onto transducer then torque tighten to 60 lb. in. (6.78 Nm.) and lock-wire.

(b) On engines with RR SB77-5322, apply a thin film of grease on transducer connector threads; screw connecting nut (6) onto transducer then torque tighten 60-100 lb. in. (6.78 - 11.31 Nm.). Wipe off excessive grease.

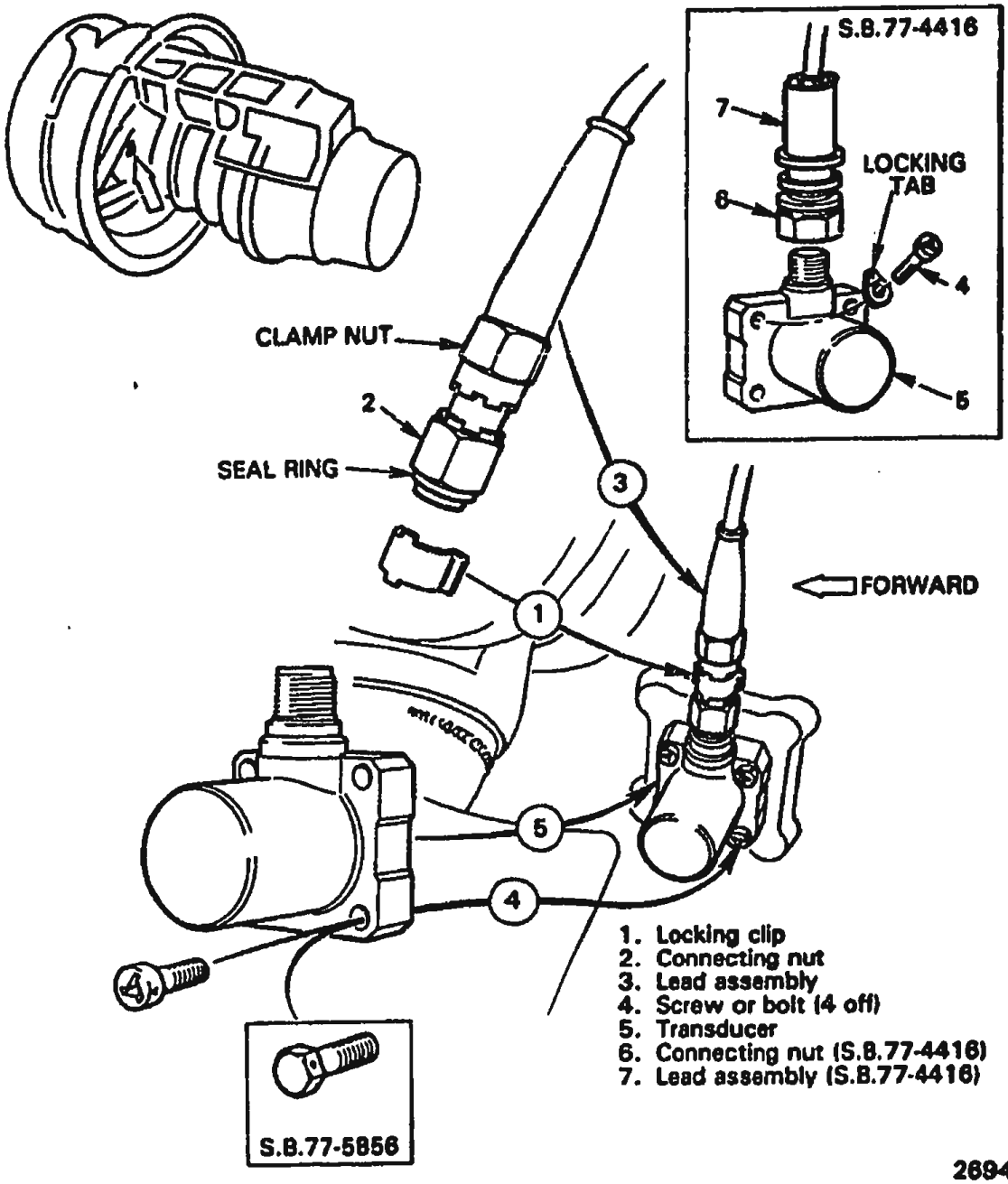
Using continuous lock-wiring technique, lock-wire together in following sequence: locking tab, connecting nut (6), connector body and lead assembly (7).

Finally, using a separate length of lock-wire, lock-wire connector body to lead assembly (7).

(13) Install compressor section rear LH fairing removed in Step 4A(4).

(14) Remove working platform from cold stream duct.

(15) Remove tags and close circuit breakers opened in Step 4A(2).



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R IP Compressor Case Transducer Lead Assembly - Disconnect/Connect
R Figure 501

EFFECTIVITY: ENGINES WITHOUT RR SB72-3310

001B

(16) Unlock and reactivate thrust reverser and associated systems (Ref. 78-30-00).

A. Engines with RR SB72-3310, IP Compressor Case Transducer Lead Assembly Connector Test

NOTE: On engines with RR SB77-4644, the disconnect/connect procedure for both transducer lead assemblies is identical.

WARNING: ENSURE THRUST REVERSER SYSTEM IS LOCKED IN FORWARD THRUST POSITION WHILE WORK IS IN PROGRESS.

(1) Deactivate and tag thrust reverser and associated systems, and install thrust reverser locks (Ref. 78-30-00).

(2) On Pilots overhead circuit breaker panel CB1, zone 210, open and tag applicable circuit breaker ENG START CONT (E13, E14 or E15).

On FE/SO aft circuit breaker panel CB3, zone 215, open and tag applicable circuit breakers ENG VIB LT (R3).

(3) Position working platform in cold stream duct.

(4) Remove compressor section rear RH fairing 412FR or 422FR for engines No. 1 or No. 3, or 432FR for engine No. 2 (Ref. 72-03-00).

(5) On engines without RR SB77-4416, remove locking clip (1) (Ref. Fig. 501).

CAUTION: ENSURE ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE DISCONNECTING.

(6) Unscrew connecting nut (2) or (6) and withdraw lead assembly (3) or (7) from transducer electrical receptacle.

(7) On engines without RR SB77-5388, remove and discard seal ring.

(7) On engines with RR SB77-5388, remove and discard nickel washer.

(8) With ohmmeter set to read on the lowest range, connect one terminal to the connector body of transducer lead assembly (3) or (7) [not the connecting nut (2) or (6)] and connect the other terminal to ground.

NOTE: Ensure all connections are good.

(9) Hold connector body firmly; manipulate vibration cable relative to connector body and simultaneously observe ohmmeter reading. If ohmmeter reading fluctuates, the vibration cable is faulty and should be replaced.

(10) Disconnect ohmmeter terminals.

(11) On engines without RR SB77-4416, connect transducer lead assembly as follows:

CAUTION: ENSURE A NEW SEAL RING IS IN POSITION AT SHOULDER OF LEAD ASSEMBLY (3) AND THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(a) On engines without RR SB77-5388, slide back connecting nut (2), install (Ref. 70-02-01) new seal ring on lead assembly (3) then fully insert lead assembly into transducer electrical receptacle.

NOTE: Ensure positive location of key.

CAUTION: ENSURE A NEW NICKEL WASHER IS IN POSITION AT SHOULDER OF LEAD ASSEMBLY (3) AND THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(a) On engines with RR SB77-5388, slide back connecting nut (2), install a new washer on lead assembly (3) then fully insert lead assembly into transducer electrical receptacle (Ref. Fig. 502).

NOTE: Ensure positive location of key.

CAUTION: DO NOT TURN CLAMP NUT.

(b) On engines without RR SB77-5388, screw connecting nut (2) onto transducer then torque tighten to 60 lb. in. (6.78 Nm.).

(c) On engines with RR SB77-5388, screw connecting nut (2) onto transducer and torque tighten to 60 lb. in. (6.78 Nm.) then, utilizing locking tab, lock-wire connecting nut.

CAUTION: ENGINES WITHOUT RR SB77-5388, DO NOT LOOSEN CONNECTING NUT (2) TO ALIGN RECESSES.

DO NOT EXCEED 100 LB. IN. (11.31 Nm.) TORQUE ON CONNECTING NUT.

(c) On engines without RR SB77-5388, install locking clip (1). If necessary, tighten connecting nut (2) slightly to align recesses in connecting and clamp nuts with lugs on locking clips.

(d) On engines with RR SB77-3168, lock-wire locking clip (1).

(11) On engines with RR SB77-4416 or RR SB71-5325, connect transducer lead assembly as follows:

CAUTION: ENGINES WITHOUT RR SB77-5388, ENSURE ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(a) On engines without RR SB77-5388, slide back connecting nut (6) and fully insert lead assembly (7) into transducer electrical receptacle.

NOTE: Ensure positive location of key.

CAUTION: ENSURE A NEW NICKEL WASHER IS IN POSITION AT SHOULDER OF LEAD ASSEMBLY (7) AND THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE DISCONNECTING.

(a) On engines with RR SB77-5388, slide back connecting nut (6), install a new nickel washer on lead assembly (7) then fully insert lead assembly into transducer electrical receptacle.

NOTE: Ensure positive location of key.

(c) On engines without RR SB77-5322, screw connecting nut (6) onto transducer then torque tightne to 60 lb. in. (6.78 Nm.) and lock-wire.

(c) On engines with RR SB77-5322, apply a thin film of grease to transducer connector threads, screw connecting nut (6) onto transducer then torque tighten to 60-100 lb. in. (6.78 - 11.31 Nm.). Wipe off excessive grease.

Using continuous lock-wiring technique, lock-wire together in following sequence: locking tab, connecting nut (6), connector body and lead assembly (7).

Finally, using a separate length of lock-wire, lock-wire connector body to lead assembly (7).

(13) Install compressor section rear RH fairing removed in Step 4A(4).

(14) Remove working platform from cold stream duct.

(15) Remove tags and close circuit breakers opened in Step 4A(2).

(16) Unlock and reactivate thrust reverser and associated systems (Ref. 78-30-00).

4. Engines with RR SB72-3732, without RR SB77-5387, Adjustment/Test

A. IP Compressor Case Transducer Lead Assembly Test.

WARNING: ENSURE THRUST REVERSER SYSTEM IS LOCKED IN FORWARD THRUST POSITION WHILE WORK IS IN PROGRESS.

(1) Deactivate and tag thrust reverser and associated systems and install thrust reverser locks (Ref. 78-30-00).

(2) On Pilots overhead circuit breaker panel CB1, zone 210, open and tag applicable circuit breaker ENG START CONT (E13, E14 or E15).

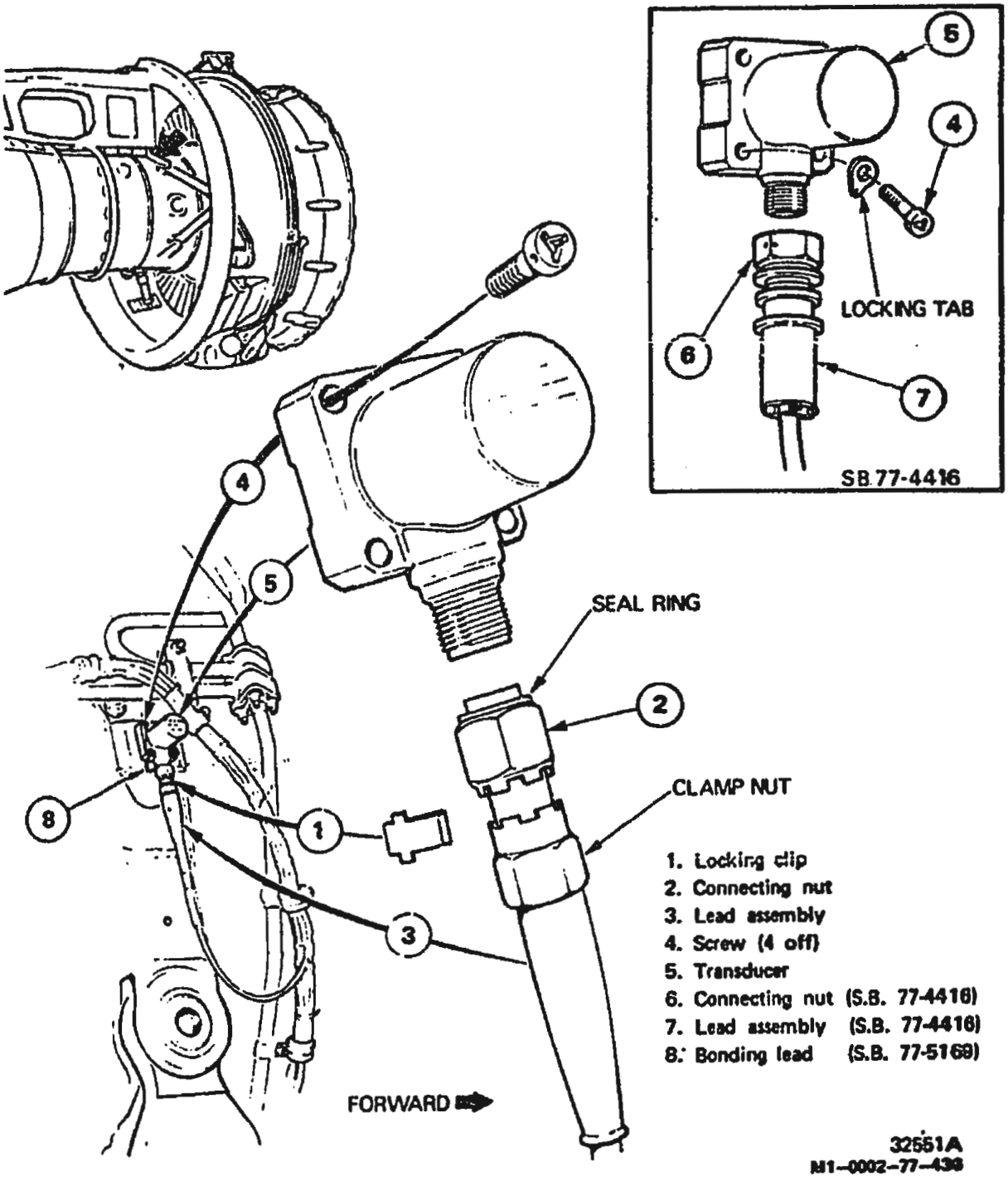
On FE/SO aft circuit breaker panel CB3, zone 215, open and tag applicable circuit breakers ENG VIB (R2) and ENG VIB LT (R3).

(3) Position spacer and side pieces in cold stream duct.

(4) Remove compressor section RH upper fairing 412AR or 422AR for engine No. 1 or No. 3, 432AR for engine No. 2 (Ref. 72-03-00).

(5) Open LH hinged cowl 413A or 423A for engine No. 1 or No. 3 (Ref. 71-11-00) or 433DL for engine No. 2 (Ref. 71-12-05).

CAUTION: ENSURE ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE DISCONNECTING.



R IP Compressor Case Transducer Lead Assembly - Disconnect/Connect
R Figure 501

R EFFECTIVITY: ENGINES WITH RR SB72-3310
R
001B

(6) Disconnect transducer lead assembly plug (plug T, 7731-P700) at engine/aircraft interface.

(7) With ohmmeter set to read on lowest range, connect one terminal to screen pin (pin number 10) of plug T and the other terminal to ground.

NOTE: Ensure connections are good.

(8) Manipulate lead assembly adacent IP compressor case transducer and simultaneously observe ohmmeter reading. If ohmmeter reading fluctuates, the lead assembly is faulty and should be replaced.

(9) Disconnect ohmmeter terminals.

CAUTION: ENSURE ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(10) Connect transducer lead assembly plug (plug T, 7731-P700) at engine/aircraft interface.

(11) Close LH hinged cowl opened in Step 4A(5).

(12) Install compressor section RH upper fairing removed in Step 4A(4).

(13) Remove spacer and slide pices from cold stream duct.

(14) Remove tags and close circuit breakers opened in Step 4A(2)

(15) Unlock and reactivate thrust reverser and associated systems (Ref. 78-30-00).

5. Engines without RR SB72-3732, RR SB77-4644 and RR SB77-5387, Adjustment/Test

A. IP Turbine Case Transducer Lead Assembly Connector Test

WARNING: ENSURE THRUST REVERSER SYSTEM IS LOCKED IN FORWARD THRUST POSITION WHILE WORK IS IN PROGRESS.

(1) Deactivate and tag thrust reverser and associated systems and install thrust reverser locks (Ref. 78-30-00).

(2) On Pilots overhead circuit breaker panel CB1, zone 210, open and tag applicable circuit breaker ENG START CONT (E13, E14 or E15).

On FE/SO aft circuit breaker panel CB3, zone 215, open and tag applicable circuit breakers ENG VIB (R2) and ENG VIB LT (R3).

(3) Position working platform in cold stream duct.

(4) Remove turbine section lower fairing 417A or 427A for engines No. 1 and No. 3 or 437A for engine No. 2 (Ref. 72-03-00).

(5) On engines without RR SB77-4416, remove locking clip (1) (Ref. Fig. 502).

CAUTION: ENSURE ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE DISCONNECTING.

(6) Unscrew connecting nut (2) or (6) and withdraw lead assembly (3) or (7) from transducer electrical receptacle.

(7) On engines without RR SB77-5388, remove and discard seal ring.

(7) On engines with RR SB77-5388, remove and discard nickel washer.

(8) With ohmmeter set to read on the lowest range, connect one terminal to the connector body of transducer lead assembly (3) or (7) [not the connecting nut (2) or (6)] and connect the other terminal to ground.

NOTE: Ensure all connections are good.

(9) Hold connector body firmly; manipulate vibration cable relative to connector body and simultaneously observe ohmmeter reading. If ohmmeter reading fluctuates, the vibration cable is faulty and should be replaced.

(10) Disconnect ohmmeter terminals.

(11) On engines without RR SB77-4416, connect transducer lead assembly as follows:

CAUTION: ENSURE A NEW SEAL RING IS IN POSITION AT SHOULDER OF LEAD ASSEMBLY (3) AND THAT ELECTRICAL CONNECTOR IS FREE FFROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(a) On engines without RR SB77-5388, slide back connecting nut (2), install (Ref. 70-02-01) new seal ring on lead assembly (3) then

fully insert lead assembly into transducer electrical receptacle.

NOTE: Ensure positive location of key.

CAUTION: ENSURE A NEW NICKEL WASHER IS IN POSITION AT SHOULDER OF LEAD ASSEMBLY (3) AND THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(a) On engines with RR SB77-5388, slide back connecting nut (2), install a new nickel washer on lead assembly (3) then fully insert lead assembly into transducer eletrical receptacle.

NOTE: Ensure positive location of key.

CAUTION: DO NOT TURN CLAMP NUT.

(c) On engines without RR SB77-5388, screw connecting nut (2) onto transducer then torque tighten to 60 lb. in. (6.78 Nm.).

(c) On engines with RR SB77-5388, screw connecting nut (2) onto transducer and torque tighten to 60 lb. in. (6.78 Nm.) then, utilizing locking tab, lock-wire connecting nut.

CAUTION: DO NOT LOOSEN CONNECTING NUT (2) TO ALIGN RECESSES.

DO NOT EXCEED 100 LB. IN. (11.31 Nm.) TORQUE ON CONNECTING NUT.

(c) On engines without RR SB77-5388, install locking clip (1). If necessary, tighten connecting nut (2) slightly to align recesses in connecting and clamp nuts with lugs on locking clip.

(d) On engines with RR SB77-3168, lock-wire locking clip (1).

(11) On engines with RR SB77-4416 or RR SB71-5325, connect transducer lead assembly as follows:

CAUTION: ENSURE ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(a) On engines without RR SB77-5388, slide back connecting nut (6) and insert lead assembly (7) into transducer electrical receptacle.

NOTE: Ensure positive location of key.

(b) On engines without RR SB77-5322 or RR SB77-5388, screw connecting nut (6) onto transducer then torque tighten to 60 lb. in. (6.78 Nm.). Lock-wire connecting nut to lead assembly (7).

CAUTION: ENSURE A NEW NICKEL WASHER IS IN POSITION AT SHOULDER OF LEAD ASSEMBLY (6) AND THAT ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(c) On engines with RR SB77-5388, slide back connecting nut (6), install a new nickel washer on lead assembly (7) then fully insert lead assembly into transducer electrical receptacle.

NOTE: Ensure positive location of key.

(d) On engines with RR SB77-5388, without RR SB77-5322, screw connecting nut (6) onto transducer then torque tighten to 60 lb. in. (6.78 Nm.). Utilizing locking tab, lock-wire.

(e) On engines with RR SB77-5322, apply a thin film of grease to transducer connector threads, screw connecting nut (6) onto transducer then torque tighten to 60-100 lb. in. (6.78 - 11.31 Nm.). Wipe off excess grease.

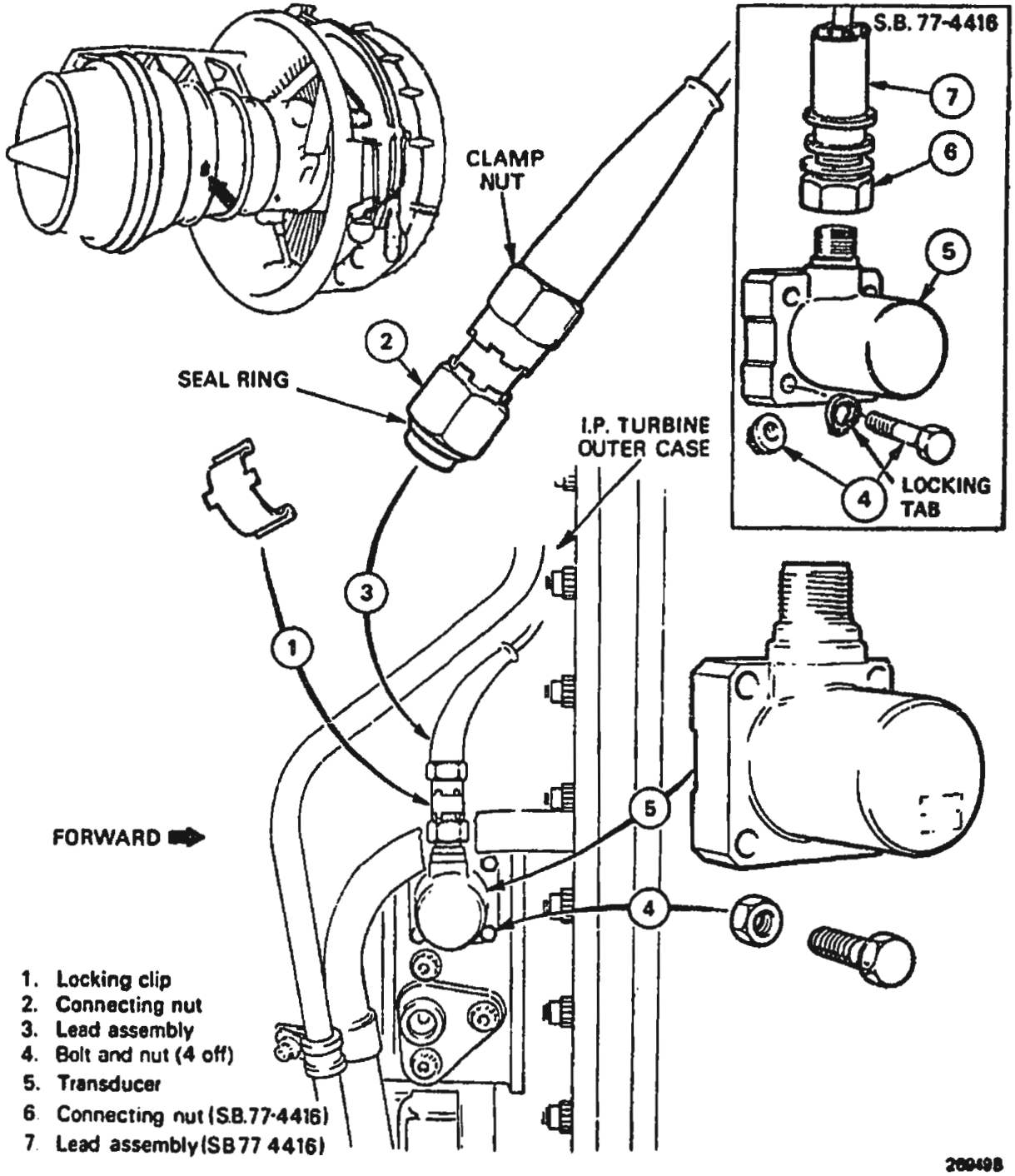
Using continuous lock-wiring technique, lock-wire together in following sequence: locking tab, connecting nut (6), connector body and lead assembly (7).

Finally, using a separate length of lock-wire, lock-wire connector body to lead assembly (7).

(12) Install turbine section lower fairing removed in Step 5A(4).

(13) Remove working platform from cold stream duct.

(14) Remove tags and close circuit breakers opened in Step 5A(2).



R IP Turbine Case Transducer Lead Assembly - Disconnect/Connect
R Figure 502

R EFFECTIVITY: ENGINES WITHOUT RR SB77-4644
R OR RR SB77-5387

001B

(15) Unlock and reactivate thrust reverser and associated systems (Ref. 78-30-00).

5. Engines with RR SB72-3732, without RR SB77-5387, Adjustment/Test

A. IP Turbine Case Transducer Lead Assembly Test

WARNING: ENSURE THRUST REVERSER SYSTEM IS LOCKED IN FORWARD THRUST POSITION WHILE WORK IS IN PROGRESS.

(1) Deactivate and tag thrust reverser and associated systems and install thrust reverser locks (Ref. 78-30-00).

(2) On Pilots overhead circuit breaker panel CB1, zone 210, open and tag applicable circuit breaker ENG START CONT (E13, E14 or E15).

On FE/SO aft circuit breaker panel CB3, zone 215, open and tag applicable circuit breakers ENG VIB LT (R3).

(3) Position spacer and side pieces in cold stream duct.

(4) Remove turbine section lower fairing 417A or 427A for engine No. 1 or No. 3, or 437A for engine No. 2 (Ref. 72-03-00).

(5) Open LH hinged cowl 413A or 423A for engine No. 1 or No. 3 (Ref. 71-11-00) or 433DL for engine No. 2 (Ref. 71-12-05).

CAUTION: ENSURE ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE DISCONNECTING.

(6) Disconnect transducer lead assembly plug (plug T, 7731-P700) at engine/aircraft interface.

(7) With ohmmeter set to read on lowest range, connect one terminal to screen pin (pin number 5) of plug T and the other terminal to ground.

NOTE: Ensure connections are good.

(8) Manipulate lead assembly adjacent IP turbine case transducer and simultaneously observe ohmmeter reading. If ohmmeter reading fluctuates, the lead assembly is faulty and should be replaced.

(9) Disconnect ohmmeter terminals.

CAUTION: ENSURE ELECTRICAL CONNECTOR IS FREE FROM LIQUID AND/OR SOLID CONTAMINATION BEFORE CONNECTING.

(10) Connect transducer lead assembly plug (plug T, 7731-P700) at engine/aircraft interface.

(11) Close LH hinged cowl opened in Step 5A(5).

(12) Install turbine section lower fairing removed in Step 5A(4).

(13) Remove spacer and side pieces from cold stream duct.

(14) Remove tags and close circuit breakers opened in Step 5A(2)

(15) Unlock and reactivate thrust reverser and associated systems (Ref. 78-30-00).

VIBRATION MONITOR (VM) INDICATOR - REMOVAL AND INSTALLATION

1. Referenced Procedure

   77-31-02 Vibration Monitor (VM) Indicator - Adjustment and Test

2. Removal/Installation

   A. Removal

      (1) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, open and tag circuit breakers ENG VIB (R2) and ENG VIB LT (R3).

      On Flight Engineer/Second Officers overhead circuit breaker panel CB2, zone 215, open and tag circuit breaker F/E INSTR (E9).

      (2) Locate the applicable VIB monitor indicator on the Flight Engineer/Second Officers ENGINE STATUS panel, zone 215. Loosen clamp screw (Ref. Fig. 401) that secures indicator in panel.

      (3) Withdraw indicator and disconnect electrical harness connector from connector on indicator. Tape and stow harness connector.

   B. Installation

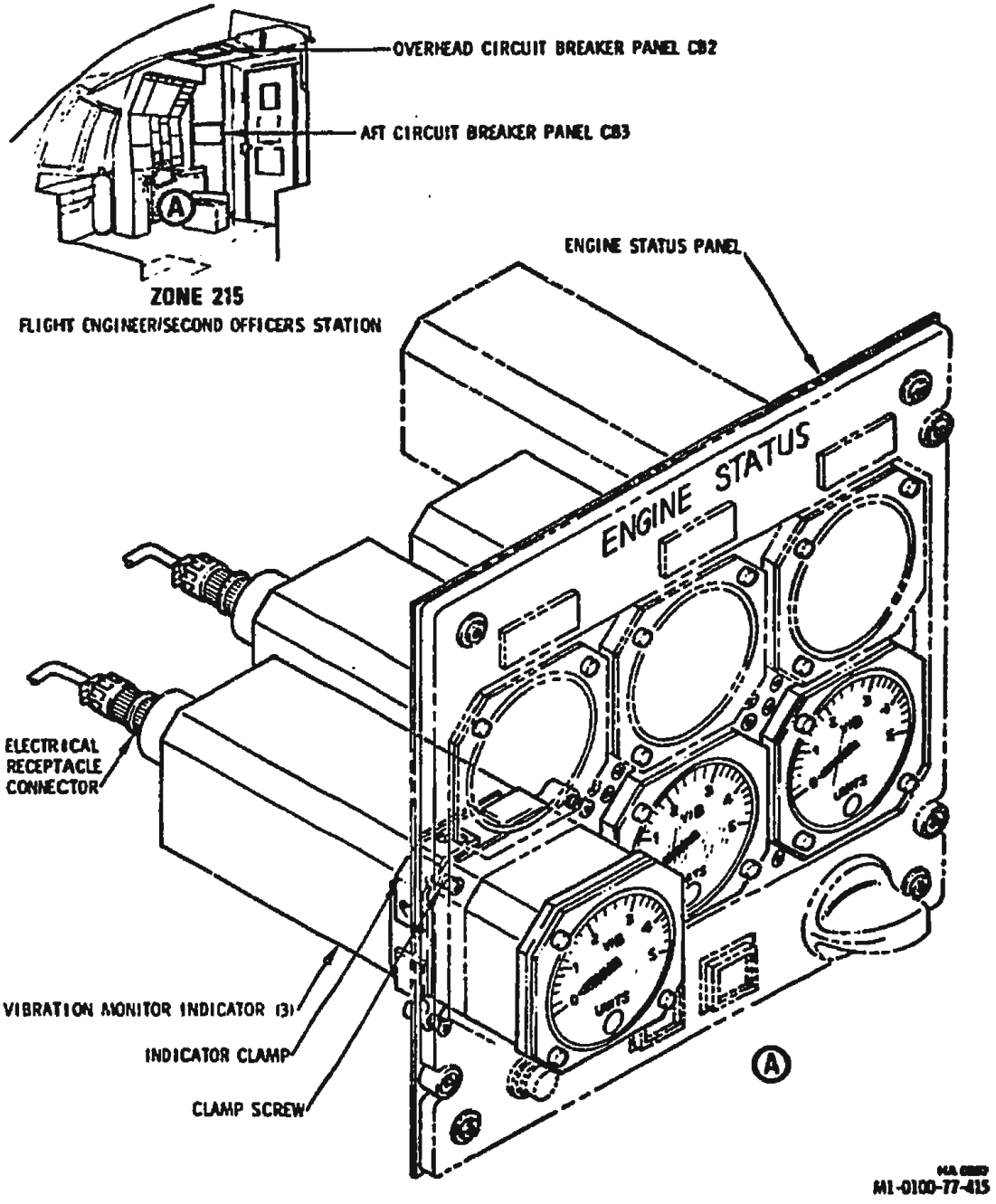
      (1) Verify that circuit breakers opened in Step A(1) are open and tagged.

      (2) Connect electrical harness connector to indicator connector.

      (3) Slide indicator into panel cutout until bezel is positioned against panel. Secure indicator by tightening clamp screw. Torque clamp screws 5 to 8 lb in.

      (4) Remove tags and close circuit breakers opened in Step A(1).

      (5) Perform indicator BITE test (Ref. 77-31-02,501).



Vibration Monitor Indicator - Removal and Installation
Figure 401

VIBRATION MONITOR (VM) INDICATOR - ADJUSTMENT AND TEST

1. Referenced Procedure

   24-41-00 External Power/Ground Service System - Maintenance Practices

2. Adjustment/Test

   A. BITE Test

      (1) Turn on electrical power (Ref. 24-41-00).

      (2) On Flight Engineer/Second Officers aft circuit breaker panel CB3, zone 215, verify that circuit breakers ENG VIB(R2) and ENG VIB LT(R3) are closed.

      (3) On Flight Engineer/Second Officers lower panel, zone 215, locate applicable vibration monitor indicator and built-in test equipment (BITE) switch in lower left corner of indicator.

R R R (4) Depress BITE switch and verify that indicator pointer indicates approximately 4.0 units and amber or red warning light on face of dial comes on.

      (5) Release BITE switch and verify that warning light goes out and pointer returns to 0.

      (6) Turn off electrical power (Ref. 24-41-00).

VIBRATION MONITOR SIGNAL CONDITIONER ASSEMBLY REMOVAL AND INSTALLATION

R 1. Referenced Procedure

R 77-31-00 Vibration Monitor (VM) System - Adjustment and Test

R 2. Removal/Installation

A. Removal

(1) On Flight Engineer/Second Officers aft circuit breaker
R panel CB3, zone 215, open and tag circuit breaker ENG
R VIB (R2).

(2) Open access doors 192K and 137AZ to enter mid electrical service center, zone 137.

(3) Locate vibration monitor (VM) signal conditioner assembly on lower shelf of right equipment rack. Identifying placard is ENGINE VIB SIG CONDITIONER.

(4) Rotate front holddown extractor knob to release tension (red indicator visible), and separate extractor from the conditioner assembly holddown hook (Ref. Fig. 401).

(5) Slide signal conditioner inboard to disconnect electrical connector from rack connector.

(6) Remove conditioner from equipment rack.

B. Installation

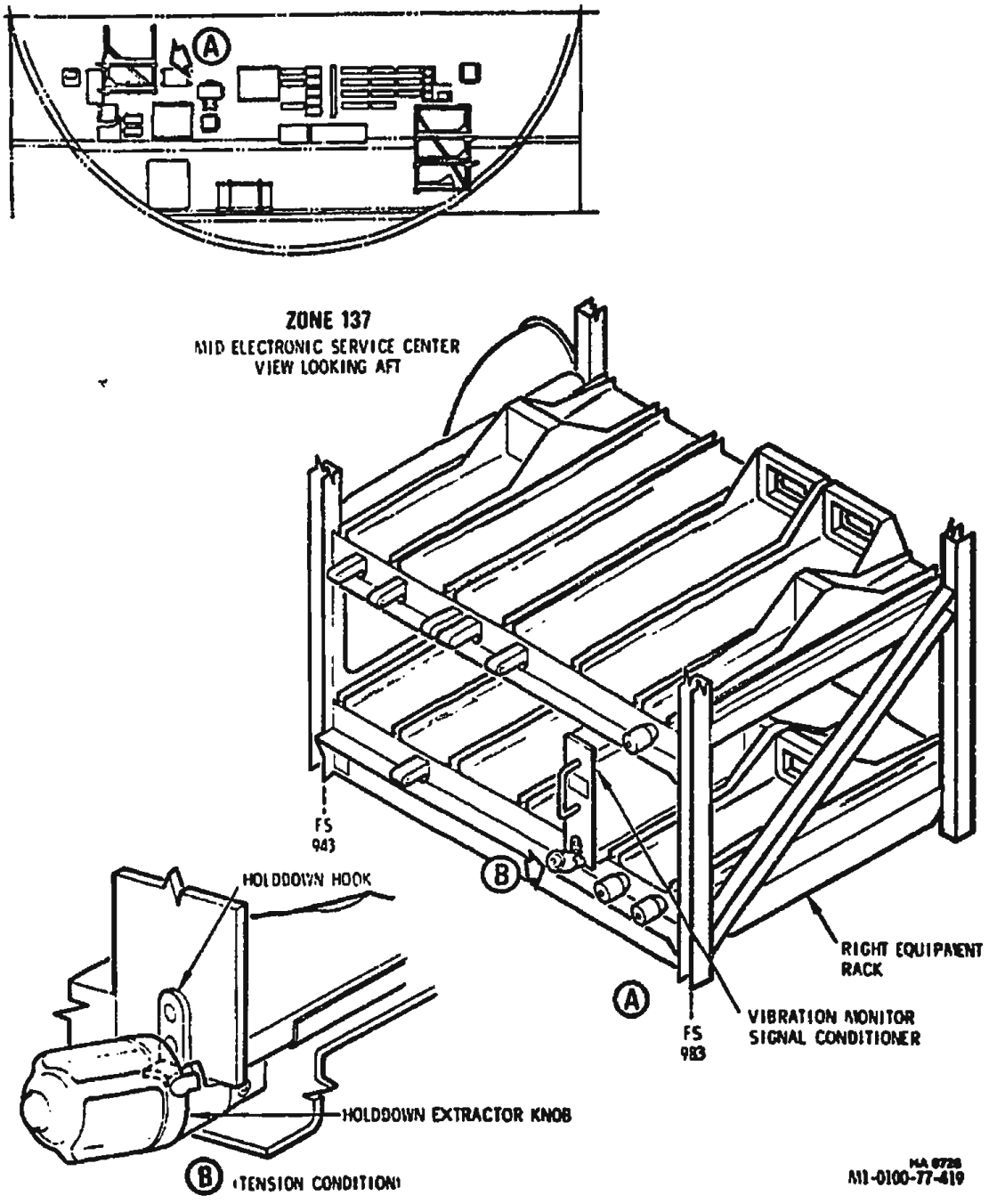
R (1) Verify that circuit breaker opened in Step 2A(1) is open and tagged.

(2) Install signal conditioner on lower shelf. Slide unit outboard to engage electrical connector with connector on rack.

(3) Engage front holddown extractor on conditioner holddown hook. Tighten extractor knob until red indicator is not visible.

R (4) Perform vibration monitor system test (Ref. 77-31-00).

R (5) Close and secure mid electrical service center access
R doors 192K and 137AZ.



Vibration Monitor Signal Conditioner Assembly
Removal and Installation
Figure 401

R (6) Remove tag and close circuit breaker opened in Step
R 2A(1).